The Infiltration of the Microcomputer in Schools in England and Wales and its Mode of Usage.

Thesis

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The Infiltration of the Microcomputer in Schools in England and Wales and its Mode of Usage.

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ABSTRACT

This study was carried out to investigate the manner in which this technological innovation was being implemented in a cross section of schools in England and Wales. Ultimately it was to ascertain the pedagogical approach employed, and if the promised revolution in teaching and learning procedures, attributed to the use of the microcomputer in education was forthcoming.

The contribution to societal needs was also investigated, and gender differences in pupil's attitude to using the microcomputer.

Suitability of chosen equipment, courseware, and problems encountered were especially sought; the result of any such problems or inefficiencies could be responsible for the efficacy or otherwise of the method.

Areas where further research was required were established.

The thesis is not of the hypothesis testing type, but more a series of case studies.

The findings are that:

(a) While the pedagogical approach mainly follows the traditional method of teaching, there is developing, in some classrooms, a change in emphasis on how children are learning.

(b) Some upper schools especially, are attempting to fulfil societal needs by changing the content of computer courses.

(c) While a notable difference develops in the attitude of boys and girls to using computers, girls, especially in the upper schools, are becoming more interested in specific topics that are being introduced.

(d) Future educational software programs need to react intelligently to pupil's requirements; the microcomputers mainly in

use at present are unsuitable. Overall they have not helped the case for computer aided learning.

(e) The use of the microcomputer in the classroom is increasing and staff resistance to using it is diminishing, despite a lack of evaluation as to its effectiveness.

(f) Perusal of educational software reveals the lack of systematic planning at the development stage.

Further research areas would be to investigate the following: the reasons for and policies to counteract gender differences, the formulation of evaluation techniques, the possibility of the use of intelligent knowledge-based systems in the classroom.

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CHAPTER 1. INTRODUCTION TO THE STUDY

GUIDE TO CONTENTS

The opening chapter forms an outline of the salient points pertaining to the research. Details are then provided of the actual situation that prevailed in the schools and colleges, relevant to the implementation of the innovation, during the four years when the research was being carried out. A review of secondary research comprising literature relating to the innovation follows. The problems relating to societal needs and attitudes to using computers due to gender is then discussed. This is followed by a discussion on the merits of the educational software and programming languges used. The conclusion expands the findings which are briefly set out in the abstract. Important areas requiring further research are then considered, followed by a mention of areas that have been either omitted or treated in a cursory manner in the research.

The computer scientist will find it easy to relate to the sections that deal with the technical aspects of programming techniques and software production. This should make them realise more fully the requirements of the non-computer user. The teacher will be able to relate to the pedagogical aspects that are expanded. They will have a better understanding of the technical aspects of writing software, but more importantly, they may be better able to recognise and handle problems they encounter relating to the attitudes of girls to using computers. They should be better at discerning the kind of software that may lead to children developing problem solving techniques.

Note:

With reference to schools in the following pages, 'lower' stands for 'infant/lower/primary', 'middle' for 'middle/junior' and 'upper'

includes 'upper' and 'high'.

The writing refers to the Department of Industry, (DoI) throughout, being the title of the present Department of Trade and Industry at the time the various references applied.

The first chapter describes the design of the study and the manner in which the investigation was carried out. It also frames the background to the research.

OVERVIEW

The study covered a very wide area and a period of almost four years, following the announcement of the Microelectronics Education Programme in England and Wales (DES,1980), and the associated, Department of Industry's launching of the Microcomputers in Schools Scheme (DoI,1981).

The educational establishments involved in this research included nursery, special, infant/lower/primary, middle/junior, upper and high schools from both the state and the independent sectors, and teacher training colleges. Initially the procedure planned for this research was delayed owing to the long delivery time taken before these educational establishments received the particular microcomputer which had been selected for use in most of them. A further hindrance proved to be the situation due to industrial action in schools, prevailing over two of the years while the research was being carried out.

In investigating the implementation of this innovation in schools, the background to computer aided learning (CAL) is reviewed. Whilst innovations are traditionally planned, this innovation was thrust upon the teachers, and they have had to get on with the job themselves without any theoretical research. The inclusion of the review is to compensate for the lack of any account of the planning stage that usually forms part of the cycle of events of any innovation, but which was omitted in this case. It is generally recognised that teachers must be fully involved in the formation of innovations. For the innovations to succeed they must also be backed with receptive professional leadership. But if the implementation had been accompanied by research, mistakes made with previous

implementations of CAL might have been avoided.

The need for national cooperation has also been advocated for the success of any innovation (Rowntree 1982), and the Government's grant scheme has at least put the microcomputers in the schools, and while the teachers mainly consider that it is now proving to be successful, no evaluation as to its effectiveness has been carried out.

BACKGROUND

The incentive for putting computer facilities in schools originated with industrialists not educationalists and continued in this way.

Teacher Training in Computer Education

Training teachers in computer education was initiated in 1962 and was due to co-operation by the computer industry, namely International Computers Limited and Hoskyns-the computer consultancy group (Bell 1979). Considering this early start, it was remarkable that in 1985 many teachers were still aware of a lack of training in this subject. The Computer Education group of the British Computer Society was formed in 1965 for teachers and others interested in the use of computers for teaching in educational establishments and to help with the provision of computer education in schools. In 1977 the Education Board of the British Computer Society produced a document giving details of the state of teacher training in England and Wales (BCS 1977), wherein it was stated that not only should some form of information processing and the appreciation of its use be part of the normal training of every teacher, but that updating courses would be required periodically during a teachers career.

The culmination of all this effort resulted in the following decision in 1984. As a qualifier for the DoI's gift to Colleges of Education of a selection of the microcomputer equipment offered to schools, every student teacher should have a twenty hour introduction to Computer Education as part of their B.Ed. course. It is indisputable that there is a need for more training in this area. But the requirement for two serving teachers from each school to attend a two or three day's course to qualify for the DoI's (DoI

1981) offer of half price equipment, while being inadequate, stretched the LEA's training resources.

Use of Computers in Schools

The infiltration of computing into schools was also initiated due to collaboration with the computer industry in the sixties. This first took the form of providing pupils with the opportunity of programming computers using batch facilities. The high volume work was later processed by universities, local government offices and anyone who could help, often preparing the input media besides running the programs. The development of time-sharing meant that those schools who could afford a terminal could link it to a time-sharing computer in a college etc.. In some areas portable terminals were shared by a number of schools. The main study of computing in schools initially consisted of teaching the pupils how to program using computers as number crunching calculators, but by 1972 the question was being debated whether there should be courses leading to the General Certificate of Education in Computer Studies/Science.(BCS1972)

While Computer Aided Learning (CAL) has been in the research stage, in the United States in particular, before the sixties, early expectations of it have still not materialised. It was stated in the seventies that CAL was going through a state of "prolonged infancy" and it was speculated that it may be going the way of the mechanical teaching machines (Binden 1975). Ten years on, the same question was still being asked. But although it may never have outgrown its infancy, it has been through a rebirth due to the microcomputer. Also despite the DoI (DoI,1981) defining computer assisted learning as 'interactive systems in which the computer "teaches" the pupil by question and answer', most teachers now realise the possibility of it rising above this role.

Equipment Development

Hubbard (1980) reported that, on average, there was one microcomputer per school in British schools in 1980, gleaned from a high percentage of returns from a survey, almost 94%, from secondary schools. A postal survey conducted in 1985 BBC/DES/MEP(1985) reported an average of 8.7 microcomputers per secondary school. Microcomputers were virtually absent in the lower schools in 1980 and now the majority have least one.

METHODOLOGY

The 'method triangulation' was employed (Webb et al,1960) incorporating elements of the survey and ethnographic type of research. This was in order that the disadvantages prevalent in one method should be offset by the advantages to be gained in the other. The survey part would counteract the threat to validity arising from the possibility of inaccurate interpretation of participant observations and discussions ensuing from employing the ethnographic technique. The survey research consisted of issuing questionnaires to a wide range of respondents in order to extend representativeness. The pilot stage simply entailed testing the questionnaires by, and discussing the content and design with, one teacher.

Observation and participation in schools and a teacher training college, combined with discussions, formed the ethnographic research. This was carried out in these natural settings to maximize the ecological validity of the findings. While it can be considered that this does not give a true picture, as people behave differently when they are observed; equally it is true that "There is often discrepancy between what people do and what they say they do".(Deutsches, 1966). Also in schools, the 'hidden curriculum' has to be searched for. Looking for what pupils are learning, in this unplanned way, is only possible by using observational and discussional methods. In relation to this study, it was hoped to discover what attitudes to computers in society were being communicated to the pupils. Informal curriculum activities could also be better ascertained by observing them, for example, the extra curriculum activities of computer clubs, held in the lunch time and

after school hours.

Participation added reliability by eventually reducing personal reactivity, i.e. after the initial novelty of a new teacher taking them, the pupils did not react so much as they do when having a person watching at the back of the room. Also by participating in this way the research objectives of the lesson could be fulfilled better when the researcher was in charge.

Because the time tabling commitments of the author were lighter towards the end of each college session, time sampling was mainly in the summer terms; the bulk of the research being carried out in 1984.

Throughout, use was made of formal secondary sources, such as reports, documents and relevant literature.

DEFINING THE POPULATION

The research subjects were the teachers and pupils from 250 colleges and schools contacted. Educational establishments in the Chiltern area formed over 50 percent of the sample because of the locality, eliminating excessive travelling; almost 80 percent of the state schools in Bedford were visited. Rural schools in the surrounding area of Bedford were also visited to see if the situation in the town schools differed from these country schools. Being concerned with typicality 15 schools in a wider area of the Chilterns were also visited. So that there would not be too great a gap between this working group, in the Chiltern area, and the general population of schools, and to enhance demographic validity, a sample of schools of all types was chosen from schools in the North of England; the Cumbria area was selected, and questionnaires were posted to schools in this area.

Another group of schools was chosen because, not only did they represent scattered areas of England and Wales but particularly because they were all schools which had won the Schools Curriculum Award. This is a national award sponsored by the Society of Education Officers, the Association of Directors of Education in Scotland and the Times Educational Supplement. It is awarded to schools which succeed in building links with the local community and aspects of the curriculum. These schools were considered of interest for critical case analysis to ascertain whether they were using computers in the curriculum more, and in different ways than the other schools.

The literature comprising the Report by H M Inspectors, on Computers in Learning, relating to studies carried out in Welsh

secondary schools (Welsh Office, 1983) provided details for comparing methods employed in English schools to those in Welsh schools.

The schools involved in the research were nursery, lower, middle, upper, special and independent. This was in order to attempt a holistic approach and compare the findings of each grade and type. But, while all types of schools were included, because many of the upper schools had been using computers for some years, initially the research concentrated more on the lower and middle schools.

It was envisaged that the teachers completing the questionnaires in these schools would be the members of staff who were generally interested in the use of microcomputers in the classroom, hence another questionnaire was completed by all the members of staff in one middle school in the Chiltern area for population validity, in an attempt to reduce bias. This school was frequently contacted and visited.

THE RESEARCH PROCEDURE

Initally the research was held up because of the late delivery of the microcomputers ordered by many of the schools. This enabled progressive focusing to formulate research questions by way of an exploratory investigation to collect data which was considered relevant to the research. This was to establish the situation in schools prior to them receiving their microcomputers and to gain lecturer's impressions on the microcomputer that the majority of schools were choosing and its associated software.

Questionnaires were ultimately sent to schools as they gradually obtained their microcomputer(s) and observation of teachers and pupils using these microcomputers in the classroom combined with participation was carried out

Observation and discussion also took place during in-service courses for teachers in Computer Education. Much use was made of telephone interviews in order to reach as wide a population as possible. Besides notes being written up after observations and discussions in order to keep the situation natural, audio and picture recordings were made at times.

CHAPTER 2. CHRONOLOGICAL RESEARCH

CHRONOLOGICAL REVIEW 1982-1985

This section contains a description of the way that the research was carried out. It includes details of the data gathered at each stage through observation, discussion, and interviews held with teachers and lecturers in schools and colleges. Results from questionnaires are also included.

RESEARCH 1982

This was mainly preliminary research to evaluate the BBC microcomputer for use in education, and to ascertain the general feeling in schools to using the microcomputer in their classrooms.

Those lower and middle schools which had a computer were in the minority, hence few schools needed visiting for observational purposes. Early in the year a computer literacy seminar was attended in order to obtain impressions of the BBC microcomputer, from those lecturers who were also attending. Following this, lower school teachers were either interviewed, when they attended an in-service course at the author's College, or were posted questionnaires. This was to obtain a preview of the situation in these schools prior to them receiving microcomputers. Later in the year, middle schools were either visited or contacted by telephone to see if the situation in these schools differed from that in the lower schools.

When the BBC microcomputers were finally being delivered to the colleges questionnaires were again issued to lecturers to obtain further impressions of this machine. It was follwed by observation and discussion amongst lecturers attending an in-service course using these machines.

QUESTIONNAIRE 1. January 1982

Respondents: Lecturers attending a BBC Computer Literacy Briefing Seminar.

No. completed: 21

AIM

The BBC microcomputer was selected as one of the choices of microcomputers which, if chosen by a school, would enable that school to take advantage of the, DoI scheme (DoI 1981) to grant half the cost of it. Hence, the purpose of this first questionnaire, completed by the lecturer's attending the aforementioned seminar, was to determine their expectations and initial impressions of the machine, the software, and the version of BASIC used. BBC BASIC would be the language most commonly used for courseware, (educational software).

RESULTS

The major attribute of the BBC microcomputer was considered to be the graphic facilities. At this time they were superior to those available on microcomputers of a comparable size and cost. The low cost of the machine was also considered an attribute, particularly bearing in mind the large number of facilities it offered. Now the same machine is considered comparatively costly, due to falling demand and subsequent competative pricing of similar machines. The greatest weakness expressed, albeit a temporary one, was the fact that the machine was not available. A number of respondents considered the choice of the 6502 processor unsuitable but did not give any reason why. Possibly it was a question of compatibility due to the fact that the Z80 chip was to be found in microcomputers in most colleges at that time.

The amount of storage available was considered to be insufficient considering the amount required by some of the routines to obtain good graphics. Quite a number of the lecturers considered the version of BASIC used by the BBC machine compared favourably with other versions of BASIC. Because of the facility provided for

structuring programs by making use of procedures, extended loop constructs etc., this was generally agreed by other users too; albeit grudgingly by opponents of the use of BASIC.

Respondent Details

While the greater number of these lecturers were accustomed to teaching on lower level courses, in general, they had used a number of programming languages besides a number of versions of BASIC. Some had no knowledge of the BBC software, and an equal number had not used any educational software what-so-ever.

Further details:Questionnaire and Summary Table, Appendices A1-A3.

Later in the same term teachers from lower schools were then contacted. Some were sent questionnaires and other interviewed. Face to face interviews were possible as these teachers were attending the In-service course in Computer Education for primary teachers held at Bedford College of Higher Education.

QUESTIONNAIRE 2/INTERVIEWS: Spring Term 1982.

Respondents:

44 lower school teachers in North Bedfordshire.

Questionnaire. No. sent: 24

No. completed: 19

Number interviewed: 20

AIM

The purpose of these interviews and the questionnaire was to obtain an impression of the current state of computing in lower schools in this area. In particular whether the school in question possessed a microcomputer, and if so how it was being used, or alternatively, if they did not possess one, whether they were planning on obtaining one.

RESULT

Only two schools out of the forty four contacted were using a

microcomputer. Out of the remaining forty two schools five members of staff used a microcomputer at home, and one, a headteacher, used a microcomputer at home for school administrative work. Nine of the schools contacted expressed no wish to obtain one. The two schools which had a microcomputer used it extensively. In one of these schools it was used exclusively for writing programs by staff and children, while in the other school, it was also used in teaching and for administrative work. The machines in use were an Acorn Atom and a Commodore Pet.

Further details: Questionnaire and Summary Table, Appendices A4-A5.

The middle school teachers were contacted next. Eight schools were visited and 18 schools contacted by phone. Discussion was also possibly with 20 teachers, attending the In-service course for middle school teachers held at Bedford College of Higher Education during the Summer term 1982.

VISITS, DISCUSSION AND TELEPHONE INTERVIEWS:

Summer term 1982.

AIMS

1. To determine the number of middle schools in the area which had a computer, and to visit these schools in order to ascertain how they were being used.

2. To get an impression of the attitude of middle school teachers to the use of microcomputers in schools and obtain the reasons why some teachers did not wish to have one.

FINANCIAL CONSIDERATIONS

Discussion with some teachers who were not using any computer in their schools revealed interest. But it was expressed that with the situation relating to staff cutting, together with the lack of software for the microcomputer, a purchase of such a machine could not really be justified, unless the price came down rapidly. While

one headteacher admitted to being impressed by what had been demonstrated in school by a teacher who owned a microcomputer, she was still cautious about buying one. One view put forward was that with so little knowledge about computers in schools, it was not viable to buy one. Various methods were being employed in order to buy microcomputers such as having a sponsored walk and reliance on parents holding functions to raise money. Other schools were interested in using one, but only if they received one completely free, i.e. by receiving half the cost from the DoI (DoI,1981) grant, and the remaining half from their LEA.

Headteachers from four schools contacted were quite adamant about not wanting one, being convinced that they could do the job without incurring such a cost. They stated categorically that they didn't know anything about computers and didn't see any reason for getting to know anything.

UTILISATION

1. Planning

The headteachers from schools who had actually decided to buy a microcomputer were already formulating plans relating to what they hoped to do with it. One headteacher was going to buy it for the mathematics department, while another was of the opinion that it should be placed in a special room of its own. It was also considered important by some to place the computer in a room only accessible to staff initially, until the staff were fully conversant with it.

2. Mode of Usage.

Of the very few schools who were already using some type of microcomputer, it was clear that it was not being forgotten about and locked away in a cupboard. These teachers expressed a wish to purchase more computers in order to extend their usage in the

classroom. But it had been realised that microcomputers were of little use with a full class because all the children were not able to see the screen.

One teacher thought that children should be aware and familiar with using computers, but considered that computers were, "not such a brilliant asset to teaching; they do nothing that a teacher cannot achieve better with chalk". But, he considered it frustrating for children, who got intensely interested in computing, then found that when they moved on to the upper school from his school, they did no more computing for a year or more. The reason given for this, at the upper school, was that children entering from other schools in the area generally had no knowledge of computing.

3. Time Factor.

This was beginning to prove a problem for the teachers, e.g. fitting in a mathematics syllabus and computer usage as well. The need for a room, already set up, and containing about fifteen computers was considered to be necessary for each school. To counteract the time required to set up equipment, the headmaster of one school visited had various machines situated in his office. The children present were his mathematics group. They were using the computers in groups of three or four. They said that their initial difficulty was in thinking out what the different keys meant; the machines in use were not BBC ones. The BBC machine has an advantage here in not having many 'software' keys. One group of girls was using text-oriented programs, and another group was using work cards produced by the headteacher containing simple program exercises. The boys had advanced and were working through the manufacturer's tutorial manuals. The head said that the girls liked working on text oriented programs rather than those requiring any mathematical

thinking. Also, this headmaster allowed the children to view the BBC literacy television programme and remarked that the boys seemed interested but not the girls.

4. Computer Club Usage.

A teacher at another school thought that computers were better used in the way that they were used in his school, that is as a computer club, for use at lunchtimes and after school. He considered that there wasn't enough time during normal school hours. When visited these children, all boys, were using the microcomputers solely for the playing of games. While the value of games playing on microcomputers is now being realised, the ones these children were playing lacked educational aims being of the arcadia type.

5. Equipment.

A small ZX81 microcomputer was being used in one classroom of another school visited. The teacher stated that some of the children were not impressed and the reason he gave was that some of these children had the use of far superior microcomputers at home. He had found that when he introduced an element of competion into computing, that it worked well. These children were observed using the microcomputer, which was always kept at the back of the classroom and used by the children in groups of twos and threes. These children are almost always in the same classroom throughout a particular year, so the machine could hardly be used by any other class. The children were quite proficient at loading the cassettes and running the programs and particularly keen to participate because they were competing with each other for marks. A chart, in the form of a ladder was kept to show the children's successes in program exercises completed, using rungs which the children coloured on completion of various routines. The teacher was rather despondent about having to make do with the ZX81 in the classroom having only

1K of storage, and not being able to write suitable educational programs; the programs in use were mainly for practice and drill. This teacher was looking forward to having a BBC microcomputer.

6. Specific Usage.

The microcomputer had been found to be especially useful in another school, for children who were, what the teacher termed, 'drop-outs' at mathematics; and in fact for remedial work in general. This teacher had also put the machine to use at the school's sports day for timing the races. He considered that using a microcomputer in the classroom relieved teacher stress providing they were able to use reliable software. Use of the machine in the classroom was enhanced by interfacing it to a large television screen, to provide better viewing for the children. When visited, a class was observed using microcomputers situated in the school library. The children were working in groups and were using programs which related to maths and science. Only one BBC microcomputer was in use and the children did not seem to favour it any more than the other three which were in use.

7. General usage.

Teachers from the schools who possessed some type of microcomputer thought that it should be used by any child and while used for administrative purposes should not be utilised mainly for that purpose. With this in mind they were careful about siting the microcomputer in order to make it accessible to the children, but at the same time placing it where the children could generally be seen while not being supervised. These teachers found that the children worked better in small groups.

Following on from these visits and interviews, questionnaires were given to college lecturers who had borrowed BBC microcomputers from the Bedford College of Higher Education during the summer vacation.

When the primary and middle school teachers eventually had their BBC microcomputer delivered, it was foreseen that they would encounter difficulties. It was expected that the lecturers from the College would, generally, already have experience of using some kind of computer so it could be expected that if they experienced difficulty in using these microcomputers, the teachers problems would be so much greater. Also at that time many of these school teachers were interested in actually programming the computer themselves.

QUESTIONNAIRE 3. Summer vacation 1982.

RESPONDENTS: lectures from the Bedford College of Higher Education.

Six of these College lecturers completed and returned the questionnaires. Five of them had already used a computer on previous occasions.

AIMS

The object of this questionnaire was to determine the difficulties experienced by these College lecturers in using the BBC microcomputer and to ascertain their view on how it compared to other machines they had possibly used. In addition it was to gain their views on the BBC BASIC together with the use of BBC machines and BASIC in educational establishments in general. Lastly it was to determine how they envisaged using the machine in their own teaching environment.

RESULT

The lecturer's main difficulty seemed to arise from the fact that

they had no one to advise them, and they did not seem to find the system helpful; in particular they considered the first user book of little help. They experienced much difficulty in saving and loading programs. They mainly considered that BASIC was a suitable language for use in schools and colleges, and generally thought that BBC BASIC was a good version, compared to other versions available on comparable microcomputers, relating to size and cost. This re-inforced early opinions on this version of BASIC, for reasons previously stated.

Further details:Questionnaire and Summary Table, Appendices A6-A8

The final research carried out in the 1982 session consisted of discussions and observation within the College.

DISCUSSIONS AND OBSERVATIONS: Bedford College of Higher Education, Autumn term 1982.

Ten lecturers attending a BBC BASIC course, Autumn term 1982. Students from the college were also observed.

AIM

The aim with the lecturers was mainly to see how they used the BBC microcomputer and to observe any difficulties they were experiencing, but also to discuss with them the potential of the microcomputer in education. Observation of students was mainly to see how they were using the BBC microcomputers.

RESULT

The lecturer's remarks, in general, related to the good graphic effects that could be achieved with little knowledge of programming using the BBC microcomputer; also they considered that the colours available were superior to those available on other microcomputers. Two lecturers remarked on the superiority of the graphics compared to the graphics on the RML 380Z. But, all considered the PLOT statements on the BBC microcomputer confusing. The reason was

because of the large number of PLOT statements provided. This would probably not affect the teachers to any great extent as any programming carried out by the majority of them would not be sophisticated routines. They would probably just use the MOVE and DRAW statements to produce graphs.

Lecturers who had programmed before were surprised at the extent of BBC BASIC compared to the facilities offered by versions of BASIC on other machines. But, the remark was passed, and agreed by others, that it was a more complex procedure producing music on the BBC microcomputer, than producing the same on a musical instrument. Lecturers who were not keyboard proficient experienced initial difficulty in using the keyboard. All these lecturers said they could see the potential of the BBC microcomputer in the classroom, and two of them, who had personal computers at home, recalled how their children were more motivated to spend time at home learning from computer aided learning programmes, even the drill and practice ones.

The students showed interest if a new game was presented, but generally used the VAX terminals, situated in the same room, for serious computing.

Findings:1982

By the end of 1982, very few primary or middle schools were using computers in the Bedfordshire area and the few which were, although developing usage with little equipment, were not using them across the curriculum. At this stage in the development of the use of microcomputers in education, children were being taught programming and the teachers were attempting to write their own programs. This may have arisen from a knowledge of the lack and unsuitability of educational software available, or perhaps it may have been due to an independent nature prominent among teachers who appreciate the

freedom to be allowed to get on with the job in hand themselves. This then was the forerunner of educational software being written by teachers rather than professional programmers. An argument can be put forward for the continued practice of teaching children programming because of the role it can play in the educational process (Bell 1984). This is expanded in the programming languages section. Despite so much criticism of the use of the BASIC language, BBC BASIC was more acceptable than other microcomputer versions of BASIC at that time, it being very similar to COMAL.

A feeling of apathy was apparent among some of the teachers concerning the use of the microcomputer in the classroom. Anti-computer feeling was also evident among many teachers. They were reluctant to pay, what they considered to be a high cost, to obtain a microcomputer when they were so short of other resources. Many considered they could do the job just as good, or sometimes better, without a microcomputer. This could have been due to the educational software in existence, being mainly poor drill and practice routines.

Problems areas, which still prevail, were emerging. The siting of the microcomputer was becoming problematic and viewing difficulties encountered when attempting to use a microcomputer with a complete class. Frustration when using cassette recorders for loading and saving programs were encountered; but teachers were quick to appreciate the value of a disc unit for classroom use. The first signs that girls had a different attitude to using the microcomputer to boys were observed. The need for in-service training in the use of computers was becoming evident. Realisation that the choice of BBC microcomputers in schools was not ideal for future use was becoming clear. This was initially stated by college lecturers on consideration of the amount of storage required to produce high resolution graphics.

RESEARCH 1983

Preliminary research carried out in 1982 provided the background for further research by revealing the problem areas which were emerging. In 1983 the research was geared towards looking at the situation prevailing within each grade of school. Early in 1983 there was little difference to be found relating to the amount of usage of microcomputers in the lower and middle schools. But, because the middle schools were included in the first DoI's grant (DoI 1981) towards the purchase of a microcomputer, it was to be expected that they would take the lead over the lower schools in using this machine in the classroom. Visits were subsequently made to both grades of schools. Schools were selected which already had a microcomputer or were awaiting delivery of one. Later teachers were observed and discussion carried out in establishments where in-service courses where taking place. Telephone interviews also took place with lower and middle school teachers. Until 1983 no research had been carried out in the upper schools. But when upper school teachers attended a micro-PROLOG course they were eventually contacted. But firstly questionnaires were posted to college lecturers who had completed a former questionnaire and had agreed to do so again at a later date. This was in order to gain further evaluation of the BBC microcomputer.

QUESTIONNAIRE 4. February 1983.

Number sent:17

Number returned: 10

Respondents:

Lecturers who had attended the BBC Computer Literacy Briefing Seminar in January 1982.

AIM

These were lecturers who had already completed a questionnaire at the Seminar in 1982. It was considered that sufficient time had elapsed for them to have received their microcomputers and to have put them to use. Hence, the aim of this questionnaire was to ascertain the amount and type of equipment in use, and the associated problems and benefits derived from using it. In general, to continue the evaluation of the BBC microcomputer, selected for use in a great number of schools in Britain. Evaluation would have preferably taken place in the schools but the majority were awaiting delivery of machines.

RESULT

The number of BBC microcomputers being purchased by each college was generally high, and they were replacing the existing RML machines in these establishments; this despite the long time taken for delivery of BBC equipment. The main reason for the change from using the RML machines, was probably the high cost of the RML microcomputers. Also the BBC machine was more user friendly, and at that time offered more facilities in the way of colour, graphics, animation and sound.

The usual problem associated with the use of cassette recorders was being experienced. The graphics facility offered was still considered to be the machine's greatest asset; marginally it was considered that the machine offered more as an educational tool, in consideration of its additional facilities, than other types of microcomputers. The purchase of the machines had led to an increased use of computers by the lecturers.

On average seven lecturers in each college were making use of them. Mainly they were available for general use by staff and students alike and the students were making use of them privately. In

teaching, the machines were being used for G.C.E.'O' and 'A' level courses in computing subjects, in-service courses in computer education, and for BASIC programming courses. They were generally kept in a special computer room.

The system was considered to be only moderately user-friendly, but the lecturers reinforced previous statements made relating to the BBC BASIC being better than versions available on comparable machines. Only one college had used CAL software and another language besides BASIC, but other colleges were expecting to do so. Some of the opinions expressed on educational software were as follows:

"Not much available", "None used", "Just started getting some", "Some good, some bad", "Mostly good".

Further details:Questionnaire and Summary Table, Appendices B1-B3

About this time the middle schools were beginning to get deliveries of their microcomputers. The lower schools were still considering whether to go ahead and purchase any. Some of these schools were then visited. In order to provide more of a follow through, schools which had already been visited the previous year were amongst those selected for visiting.

VISITS:spring/summer terms 1983

Schools visited: 10 middle

7 lower.

AIM

The aim was to get an impression of how the schools, which had received their microcomputers, were coping and how they were using them. It was also to ascertain what those schools which had not received them were expecting to do with them when they were

delivered. Opinion on the software that was available was also sought.

Middle schools: microcomputer delivered.

1. Staff Involvement.

Overall, the number of staff at each establishment using the microcomputer was very small. The teacher who was involved with computing, at a school previously visited, was still rather dismayed that the teachers using the computer were still the same two in the mathematics and science group. This teacher had particularly tried to get other subject teachers interested in the use of database software for information retrieval purposes, but said it had been an unsuccessful attempt. On a visit to a different school, though, the microcomputers were being used by both art and science teachers. Some teachers were using them for demonstrations in front of the class. When this school was visited the previous year, the mathematic teachers were the only ones making use of it. There were signs that headteachers were not taking an active part in actually using the microcomputer. One head said he considered his role to be that of providing lots of equipment and then encouraging the rest of the staff to take over.

Surprisingly, in a discussion about overcoming the difficulties encountered in using a microcomputer, a teacher from yet another school said that she had taken it home once, but that there was competition for it, as the teachers were wanting to take it home every night. Interest in using the microcomputer in the classroom was clearly evident in these schools, but there was also a lack of confidence, due to a lack of training.

2. Placing of Equipment.

The problems associated with the housing of the microcomputer equipment and the subsequent time and energy taken in carrying it

to a classroom and setting it up were very clear. The need for a special room was expressed. For security reasons some schools had to keep the microcomputers locked up, and when kept in an upper floor room in a school with no lift, the use of a trolley was not feasible. This condition was found in many schools, where teachers said that moving equipment around on trolleys had not been considered when schools had been built. The suggestion, put forward as an answer to the floor level problem, was to have sufficient computers to be able to keep them on trolleys and then assign a number of them to each level. A favourite location for the equipment was found to be in the school library. An information retrieval unit was to be set up in one school library when they had purchased Micronet 800 (3) and a printer. In general the siting of equipment in schools was, and still is, a real problem and one which makes the teachers think twice before deciding to make use of the microcomputer in the classroom.

3. Software.

A favourite piece of software in use was Dart(1). An opinion expressed was, that it was not suitable for the advanced, top-level bands in mathematics. Yet the 'real' LOGO language is used in the upper schools, but Dart is simply a graphics package. School data was being written onto files using the database software Quest (2) by the chidren from one school. The difficulty was that the files were getting full. These children had a computer club where they mainly ran simulations and educational games every lunch time. Another school, where they had been using computers before 1982, had six BBC microcomputers and had handed their RML 380Z over to the science teacher for use in science only. The teacher thought that the science programs for the 380Z were too sophisticated for middle schools. He hoped that with the formation of the Science User Group

for science teachers, that more software would become available and interchange possible. He thought that for middle schools the real thing was better than simulations, although did consider that there was some good science simulations for the higher age group. The software in use in this school, besides Dart (1), was database type software, but a little BASIC programming was taught. Every child in this school used the microcomputer some time before leaving.

4. Gender

The different attitude of the sexes to using the microcomputer had mainly been found in the computer clubs. Girls had had to be given different computer club days to the boys, because the boys were 'inclined to push the girls out.' Another opinion expressed was that only the boys were really interested, and only in games; this school was situated in a rather poor area. While one school computer club had an equal number of girls as boys interested in it, the girls were said to want to run ready made programs while the boys were continually wanting to explore and write their own programs.

This school is situated in quite a good residential area. Here socialogical implications are evident relating to attitudes to the way computers are used. A teacher from another school was unhappy about the use of the microcomputer in his school, as he said it was only used for playing around with in the computer club. This teacher had to tell the boys to let the girls use it.

5. Specific Usage

The member of staff in change of a remedial unit at one middle school said he required a microcomputer especially for the unit rather than sharing it with the rest of the school having found it ideal for these pupils. The main problem was to find something that would hold the children's interest for longer than ten minutes, otherwise 'they flare up and go all to pieces.' He found that

educational games held their attention, but that even groups of about five were too big as they were inclined to have to wait too long to have a turn. These children were mainly maladjusted children from broken homes. The teacher considered that there had to be an element of games in the programs they used.

Other middle schools still awaiting delivery of a microcomputer were then visited.

Middle Schools: awaiting microcomputer delivery.

Interest was shown in using the microcomputer for administration although it was expressed that it would not be used solely for that purpose. Teachers were unclear as to the purpose of putting a microcomputer in every school but some seemed to consider that it may be for administrative purposes. One headteacher was so keen on using a microcomputer for administrative work that he had decided to use the grant to help purchase a RML 380Z as he considered this machine would be the better choice for this kind of work. At that time this head thought the Commodore Pet was much better for classroom use than the BBC microcomputer, but could not offer any reason why. Since then this school has purchased BBC machines. A few teachers were formulating plans as to how they would use the microcomputer when it was delivered but others were not sure just what they were going to do with it. The in-service induction course had made a good impression with one teacher. This teacher had been very "anti" about the use of microcomputers in the classroom initially, but after attending this course was keen to keep acquiring equipment.

Some lower schools were then taking delivery of a microcomputer and were subsequently visited.

Lower schools: microcomputer delivered.

Utilisation.

1. BIGTRAK as an introduction.

Some of these lower schools were following a set procedure in using the microcomputer. They had found BIGTRAK, the programmable toy tank, a good introduction to using a microcomputer. The children were very methodical in their approach. After the teacher had presented them with a problem they wrote all the instructions down first and then tested them step by step before having a first 'run'. The way that some teachers perpetuated the problem relating to girls not using the microcomputer as much as boys was evident in one class. When the request was made for a group of children for experimental purposes in using BIGTRAK, the teacher selected boys only. This teacher showed surprise when asked for girls to be included. These were five year old children.

2. MOVES as a follow-up.

The program MOVES (5) was written as a progression from BIGTRAK to the microcomputer. This software uses the same type of instructions as that required for manipulating BIGTRAK. The group observed using this software revealed how discovery learning was not ideal for some children and that they often required guided discovery learning. The teacher left these children to experiment on their own and after drawing some simple squares they soon lost interest. Then when older children joined them and made suggestions, such as trying to draw their own names, the younger children all regained interest again.

3. Use of LOGO.

The use of the 'real' LOGO language with the floor turtle was only to be found in one school. An interesting detail to emerge from this visit, was when the teacher admitted to being a much more confident person since starting to use the microcomputer in project

work with his class. He had found his confidence had increased in his teaching and in his involvement with visitors who came to see the children working on the project. The visitors also had remarked on the improvement in friendliness and confidence in this teacher. Discussion with a small group of nine year olds at one school, showed that they were very proud not to have needed to enact the moves before writing programs using the Dart (1) software, like the younger children had to.

4. Introduction of Simulations.

A project using the Mary Rose (6) software was being used for all parts of the curriculum in one lower school. This particular piece of software comprised two parts. First a survey to find the Mary Rose, a Tudor ship sunk in the Solent, followed by a program dealing with the diving and exploration of the wreck. Even the vicar had introduced religious studies into the project, visiting the class once a week for this purpose. The class worked on the project for three or four half days for the complete term and even then the teacher did not complete all the work that she had expected to do. The teacher thought the children may have got rather bored with it, but they had not. The accomplishments of the children, while working on this project, were in evidence around the classroom in the many models on display. A similar project was carried out in another lower school using the simulation package, Expedition to Saqqara (7). This forms a realistic, archaelogical exploration which simulates a search for ancient Egyption tombs.

5. General Points.

Relating to software, it was stated that sometimes it was supposed to be for a particular age group but no account had been taken of children's understanding of the words used; repeatedly the teacher had to explain the meaning of some words to the children, and for

words which normally would not have used with children of that age. The schools were experiencing a long waiting period before the microcomputers ordered were being delivered. Some lower schools mainly in this category were visited.

Lower schools: without or awaiting microcomputer delivery.

The general situation was that if the microcomputer was already ordered the teachers did not really know what they were going to do with it when it was delivered. Teachers were depending on gaining ideas on how to use it when they had attended the LEA induction course. They considered that they were fortunate in being able to afford half the cost towards one microcomputer and could not possibly see how they would ever be able to afford another.

Various reasons were put forward by those teachers who did not wish to have a microcomputer. In a low attainement area it was considered that the teacher would have sufficient problems to overcome without having time to think about microcomputers. The problem of age was also put forward, in that if teachers were nearing early retirement they were not kindly disposed to introducing microcomputers in their classroom. That teachers of a mature age do not wish to use microcomputers in their teaching has repeatedly been stated throughout this research. The lack of understanding was also expressed as a reason for not wishing to use the microcomputer. The need for demonstrations in order to show the educational value of a resource, but also to aid understanding, was clear. It was recalled how one headteacher on seeing BIGTRAK demonstrated had immediately ordered two, hence reinforcing the need for demonstration; the potential use of this particular educational toy in schools had been immediately apparent to him.

The reaction from teachers both in the middle and lower school who

were awaiting delivery of their microcomputer was that they did not know what they were going to do with it when they did receive it.

The In-service Certificate of Further Professional Studies course, for primary and middle schoolteachers, held at Bedford College of Higher Education, proved extremely valuable. Not only did it provide an opportunity to observe the teachers using software, but also the opportunity of being able to listen to the ensuing discussions.

DISCUSSION AND OBSERVATION:Spring/Summer term 1983.

(i) In-service certificate courses:spring/summer 1983.

Two courses attended by 40 teachers.

Software discussion

The discussions revealed that the teachers did not always agree on which software they consider to be 'good' and which they did not. With some of the arithmetic programs, the teachers thought they could do just as well with a chalkboard and work cards. The conclusion seemed to depend very much on the level reached by the children that they were teaching. Often argument ensued over some particular piece of software, which some teachers considered useless and others considered to be ideal for particular groups of children that they taught, and had experienced difficulty with when attempting to get understanding of specific points over to them; these teachers thought the software overcame the problem.

The LOGO language was criticised by the teachers as only being useful for teaching mathematical concepts; they were not enlightened by the lecturer to the other facilities offered by the 'real' LOGO langauge.

Discussion about database types of software revealed that the teachers did not really know how they could use them. Two teachers said that they had used some software simply to create a file

containing historical data relating to the area where their school was located, but that they had used it simply to look at the complete file without seemingly considering what use they were going to put the data to before they created the file. The use of a file for interrogation purposes was pointed out to them but they still struggled to find useful purposes for such software.

Some teachers expressed doubts about the language used in some software; for example, one retort used in one piece of software was: 'You silly idiot'. Concern was expressed about this, the teacher stating that if this expression was repeated often enough to some children, they would eventually be convinced that they were silly idiots. The opinion generally expressed, was that they would certainly not buy any software before viewing it first, even though it had been recommended; the reason put forward was that what one teacher thought would be good, another may not. One member considered that the software that they had been shown on the course was rubbish, including the MEP Primer Pack (4), but with the exception of Dart(1) and Mary Rose (6). When shown how to amend existing software to their own requirements, these teachers generally found it extremely difficult. Relating to discussion about methods of evaluating software; the opinion was that the MEP questionnaire devised for evaluating software was not suitable, but they were undecided as to the best way of framing one themselves.

Much discussion among middle school teachers took place at an induction course held in May 1983 organised by the LEA; attendance was obligatory for teachers who were representing those schools which had selected a BBC microcomputer as their choice of computer under the DoI grant scheme (DoI 1981).

(ii) In-service induction course. Summer Term 1983.

Content.

The teachers were given demonstrations of simulation and database type software, audio input, use of a graphics tablet, wordprocessing, electronic mail including Micronet 800 (3), and the LOGO language using a concept keyboard. A MEP Input Pack (8), was given to each school and the teachers were encouraged to try the pack out during the practical sessions.

Software.

Discussion about software led to general agreement about the small amount of good software that was available, but also that there was little software available for disc users. The point was then put forward that really little software was required if the right software had been selected. One headteacher said that in his school Dart(1) and Quest(2) were mainly used.

Siting equipment.

When the problem was raised relating to the siting of computer equipment, a headmaster categorically stated that he considered that computers should be used as portable units and did not like the idea of a school having a computer laboratory. This headteacher considered that computers should come under a head of resources, or better still that a particular person should be a head of computer resources in order to break the ties between computing and mathematics and science, and that software selection should be carried out by the subject teachers. But, in most schools visited subject teachers were not even aware of what software was available in their particular subject area. Also despite the advice that schools should not put a special room aside as a computer room, this is what many schools are now striving to attain because of the difficulty of carrying equipment around.Administration.

While some of the teachers, particularly headteachers, were interested in the use of the BBC microcomputer for administration

purposes, this was immediately crushed by the computer adviser who was present.

Throughout the summer term telephone interviews were held with teachers from middle and primary schools.

(iii) Telephone contact. Summer Term 1983

No. contacted 20:

9 middle schools

11 primary schools.

Introducing microcomputers.

Many of the primary schools were still awaiting delivery of their BBC microcomputer. One primary headteacher said that the children were so impatient waiting for their microcomputer, that she had brought her own ZX81 in for them to use. Some teachers were still undecided about purchasing one. They were more interested when they had the opportunity to actually see one in use. The College made a practice of lending machines to schools and often its potential, particularly for remedial work, was immediately seen. The remark was also made as to how it had improved social skills, showing children how they had to share and wait their turn to use the computer, and the discussion amongst themselves that its use had brought about. Also, it was stated that it improved their 'visual memory' and their concentration. When questioned about the meaning of this latter statement this particular teacher thought that seeing words on the screen made them remember them better. College lecturers had been visiting this school and using the microcomputer with the children and the head considered that it had been very good for the teachers by showing them how to introduce computers in the classroom. This head thought that BIGTRAK was really better for young children.

Problems

One worry expressed was the problem which these teachers envisaged as a manning one; they considered that the children could not be left alone using the computer and there would be difficulty in looking after all the small groups in this way.

Initial resistance to using the microcomputer in the classroom was admitted on one occasion both from the staff and the headmistress. She said that she had initially thought that she wasn't going to have a computer tell her what to do. Her approach had been to get the staff feeling fully confident with it first and said that it had been used very little by the children initially, but had been kept in the staffroom for the staff to tinker with as they wished. This had made them feel better about it and lessened the resistance. The deputy head at this school had used it a little with the children and said that the children had more confidence with it than the teachers. This was because quite a number had computers at home. But they had still not decided exactly how they were going to use it with the children; the staff were going to review the MEP Primer Pack (4) during the summer vacation and they would decide after that.

Although much work has been carried out in order to draw the possibilties of micro-PROLOG to the attention of educationalists, with the exception of one or two projects, the progress of PROLOG in the classroom proceeds extremely slowly. A course was held at Bedford College of Higher Education in micro-PROLOG for teachers, and then the LEA held a similar course. The teachers who had attended the latter course were subsequently contacted.

Micro-PROLOG In-service Course 1983.

18 teachers, mainly from upper schools, attended this course. The

majority of the teachers were interviewed by telephone. With the exception of one teacher, they had not followed the course up. They said that this was because they had not liked PROLOG, considering it cumbersome, complicated, and the structure artificial. Some of the teachers expressed concern and others were horrified at the idea of introducing the kind of language used in micro-PROLOG into schools. They maintained that many pupils were already extremely poor at language and wondered what the effect might be of showing them statements which incorporated such bad grammar as,'Does John likes Mary?' They thought it most unsuitable for pupils and considered a full implementation of LOGO would be better for them. The general feeling was that the language would have to be available in a much more simplified form, before it would be suitable for school use. They considered that it needed to be completely re-arranged, and mentioned the strange manner in which the user had to phrase questions. The high price of the only version available for a microcomputer at that time, had finally put them off it completely. Some of them said that they would be willing to try it again if they were given a free copy, and considered that it probably would be used in schools in the long term. Since 1983 this implementation has been much improved.

The teacher who had followed up the course had introduced micro-PROLOG in the classroom to build a database, in order to clarify certain mathematical concepts. He had entered relationships between certain shapes and then applied rules in order to produce other relations directly. On visiting this class, the children were quite interested, but some of them said that they had done all the work about defining shapes in class before, in the ordinary way, and wondered why they were doing it all again, just to enter it in the computer. They said it could have been done just as easily on the

board, but some of them did say that then they would not have been able to retrieve it. The teachers on the course showed more interest in the use of PROLOG with graphics, (Ball 1983) a project investigating the use of micro-PROLOG in the classroom with pupils aged between eleven and fourteen. Graphics had been added to micro-PROLOG for the RML 380Z microcomputer by appending machine code routines to implement 'turtle geometry'. The software was being tested in four schools, initial response from teachers was favourable. But, with the full implementation of LOGO now available for the BBC microcomputer the need for this facility to be appended to micro-PROLOG does not seem viable, unless it could combine with the database facility of PROLOG.

The majority of the teachers on this course had not taken to PROLOG at all. Quite a number had been teaching computing for a few years though and the suggestion was put that they may have been looking at it from a too sophisticated level. The opinion was that the pupils may have accepted it more readiliy. The subsequent course the following year, specifically for six formers proved this surmise to be correct.

Findings:1983

Throughout 1983, although much interest was shown among teachers in the use of the microcomputer in the classroom, the impression gained was that they had had the microcomputers 'thrown' at them and were wondering what to do with them. Teachers were hoping that when they attended the induction course they would then get some ideas, but those who had attended this course were still unsure. It was noticeable that the children were more confident in using the microcomputer than most teachers. The majority of teachers seemed to be struggling along to gain competency in the operation of the

microcomputer, and it was quite apparent that they needed more training in the use of it to overcome their timidness and give them more confidence. Many found it difficult to get a place on in-service courses considering themselves fortunate if they were selected. Older teachers were not accepting the microcomputer readily. The higher scale posts offered to teachers who had a knowledge of computers in education, were generally to the younger ones and this created friction among the older members. In the past these posts had only been filled by the more experienced teachers. Some of the teachers who had shown anti-computer feelings were considering that the opportunity of getting a microcomputer at half price could not be missed. Headteachers were clearly keen to make use of it for administration purposes. The mathematics and science teachers were still the major users of the microcomputer, but use in remedial work was being realised. Efforts were being made to enable every child to use the microcomputer. This was often a means of appeasement, particularly to parents, so that the child could relate having used the microcomputer. This could not be said to make profitable use of the machine, but simply made these children slightly familiar with it.

The software being used by the schools was mainly that which had been provided by the LEA and the MEP. The type which helped children with problem solving was in use, but many drill and practice type of programs were also in evidence. Many of these programs were unreliable and programmed so that the teacher was not in control of the procedure. A major fault was that when the program became faulty, the teacher had no means of knowing how to terminate the 'run' and often had to re-load it using slow cassette players in order to continue. BIGTRAK was making quite an impact in the lower schools. Some of the software being used on the microcomputer

provided a follow up to the type of problem solving they had used to manipulate BIGTRAK and which eventually led to using a subset of LOGO. Selected schools were taking part in the Chiltern LOGO Project (Noss 1983) which used the full LOGO with the accompanying floor turtle. The aim of the project being to evaluate the potential of LOGO in the classroom. This is discussed further in the programming languages section.

File processing applications to enable children create and interrogate data files were beginning to be used. Simulations were also starting to be used. Successful projects were being carried out in schools with simulation packages used across the curriculum. But few schools were using these applications. Educational software houses were starting to hold preview sessions of their software in schools after school hours. Discussion on software showed that some teachers were beginning to be quite capable at discerning what was rubbish and what was reasonably good. Teachers can distinguish what is educationally good, even though they put up with much that is technically bad, because they see some redeeming feature from an educational evaluation of it. BASIC was generally the only computer language in use, except in a very few schools which had the full implementation of LOGO; although attempts were being made to introduce PROLOG into schools. The majority of the teachers on a course to introduce them to micro-PROLOG had not taken to it at all. The version in use at that time, was very unfriendly and clumsy to use. The problem of transporting equipment around classrooms, in schools built on various levels, and then having to set it all up, was becoming more prominent. The difference in the attitude between boys and girls when using computers was increasing.

RESEARCH:1984

Research carried out during 1983 showed that the BBC microcomputers were eventually available and by 1984 many schools were using them in the classroom, hence much of the research was carried out during this period. Schools of all types in the Chiltern Area were visited. The use of micro-PROLOG in schools was investigated. Upper schools visited were the ones where the pupils had attended the micro-PROLOG course for sixth formers. Teachers on in-service courses were observed and discussion carried out. But first, in order to get a wider response, questionnaires were sent to a selection of schools, a total of 172, the majority situated in England.

QUESTIONNAIRES:1984

RESPONDENTS:teachers from special, lower, middle, upper and independent schools:

(a) in the Chiltern area, summer term 1984,

(b) in Cumbria, summer term 1984,

(c) who had obtained the Curriculum Award, autumn term 1984.

Total number sent: 172

Total number returned: 133 77% response rate.

CHILTERN AREA SCHOOLS

Number sent: 70

Number returned: 64 91% response rate.

CUMBRIAN SCHOOLS

Number sent: 62

Number returned: 48 77% response rate.

CURRICULUM AWARD SCHOOLS Number sent: 40

Number returned: 21 53% response rate.

AIM

To determine:

(i) the number of microcomputers in these schools, who was using them, how they were being used, the software in use, the difficulties that were being experienced in using them, and the general feeling of the staff towards the innovation.

(ii) if the approach differed according to the type of school.

(iii) if the approach differed according to area.

(iv) the type of approach employed in the curriculum award schools.

Questionnaire A: Special Schools 1984.

Result.

	Chiltern Area.	Cumbria.	Curr.Award.
%Response	100	100	100
Av.no.micros. per school	2.5	1.25	1
No.of pupils per micro.	12	20	*
% of BBC'S	49	60	100
No. of schools without micros	1	2	0

* only the one school was contacted: the roll was not provided.

Usage

In all three areas the use of the microcomputer for the disabled and maladjusted child was realised. The value of specific peripheral controls for the physically handicapped was commented on. The microcomputer was used in a rather different way from other schools, e.g. much individual usage, and used according to disability. While the majority of teachers in Cumbria were aware of the microcomputer's worth for helping the children in these schools, a minority considered it of little value for those with behavioural

problems and the severely handicapped. But they were still eager to attend courses, hence they could be enlightened about the value of specific equipment for the severely handicapped. It was generally appreciated that more use could be made of the microcomputer if more staff were trained to use it. Repeatedly words like-'apathetic', 'suspicious', 'anxious', 'terrified' etc. were used, in relation to the feeling of the staff towards using the machine. A general keeness to learn was evident.

Software

The shortage of software specifically for special schools was expressed. The teacher's opinion on software was that they did not use it, it being inappropriate, or that it had limited value and they used it discriminately. Appreciation of software that could be used with the concept keyboard was clear. It would seem that the program for converting software for this purpose was not commonly used. An assortment of programs which had been found to be useful was quoted. In the Chiltern area, Dart (1), Quest (2) and Tree of Knowledge (12) were favourites. Overall though, software that contained a games element was prominent in the listings given. Four Special Education Microelectronic Resource Centres (SEMERC) had been established by the MEP in 1982, and were proving to be a useful source for obtaining software. Other programs used were said to have been written by friends or by the teachers themselves.

Gender Differences

One teacher's opinion was that the boys were more confident and eager to use the microcomputer than the girls and they were keen on using it to play games. The girls were thought to be more diffident about using it. But overall, the difference between the attitude of boys and girls to using computers was negligible.

Problems

The usual problem relating to the loading of cassettes was repeatedly expressed. The upper case keyboard had been found to present difficulty for these children, and these schools had the additional problem of obtaining the special peripherals which were required. Some schools had found that the children needed more supervision when using the microcomputer. There was a lack of software for children with severe learning difficulties. Staff training problems were evident and in the Cumbrian schools, a lack of enthusiasm among teachers was commented on. Although the mobility problem was mentioned, these schools were, and are, generally located on one level.

General Comments

The interest that the staff were beginning to take in the use of the microcomputer in these classrooms was reflected in the full response to the questionnaire. Additional material was freely offered by a number of the schools in the Chiltern area. A positive attitude was reflected in response to the request for opinions on the use of microcomputers in the classroom-albeit many were apprehensive. There was limited use of the microcomputer in the Curriculum Award school due to the staff being untrained in its use.

These schools, generally purpose-built on one level to accommodate disabled pupils and the use of wheel chairs, benefited by facilitating the transporting of computer equipment around on trolleys.

Further details: Questionnaire and Summary Table:

Chiltern area special schools-Appendices C1, C2, C3.

Cumbrian special schools-Appendices C1, C2, C4.

Curriculum award special school-Appendices C1, C2, C5.

The lower schools in the three selected groups were then posted questionnaires.

QUESTIONNAIRE B: LOWER SCHOOLS 1984

RESULT

	Chiltern Area.	Cumbria.	Curr.Award.
%Response	67	70	50
Av.no.micros. per school	0.86	0.86	0.71
No.of pupils per micro.	200	250	280
% of BBC'S	92	92	100
No. of schools without micros	4	1	1

Usage

While these teachers were often keen on using the microcomputer in the classroom, and considered that it offered quite a different approach to teaching, the situation relating to staff training was the same as in the special schools. Because of this they were hesitant and reluctant to use them. But they were very keen to learn, especially those teachers in the Chiltern area. Those from schools in the other two groups were more critical in their approach. Doubt was expressed about the necessity of using microcomputers in an infant school and that in any case its use should not be over-emphasised, considering that the money, used to purchase it, could possibly be better spent. The Curriculum Award schoolteachers offered comments such as the microcomputer being of no use for first schools and that it should not form part of the general class equipment. Some thought that, in any case, it should not be a first priorty in equipment selection and that BIGTRAK was

the better machine. A number were reserving judgement on its use, while others were determined not to use it. Teachers were unwilling to give up teaching time in order to accommodate it. Despite this criticism, the microcomputers were being used daily by all classes in over 50% of the schools contacted.

Software

The shortage and inadequacy of the software again formed a prominent response to questions. The MEP Pack(4), Dart (1),Tree of Knowledg(12), and Granny's Garden(13) were much used in schools, both in the Chiltern area and in Cumbria. The teachers in Cumbria were more critical of the educational software available than those in the Chiltern area. The former teachers' responses contained statements such as educational software mainly not being worth bothering with, and that it was not tailored for infant work and usually needed editing. But, the teachers in the Chiltern area did consider that there were too many drill and practice programs, and thought that while there were some 'gems', all software needed reviewing first. These latter teachers were starting to make use of wordprocessing and database type software. The Curriculum Award schoolteachers offered responses like, they 'hadn't had time to look at any', and 'was it going to be cost-effective?'; others thought it 'unimagineable', 'disapointing' and that 'there was not enough available for use with infants'. Very little detail was given about the source of software from these lower schools other than that provided by the LEA. Hence, it could be assumed that these lower schools were only using software that the LEA had provided. Subsequent visits endorsed this assumation.

Problems

The shortage of hardware was reflected strongly in the responses from the schools in the Chiltern area and in Cumbria. There was

also a lack of computer knowledge prevalent amongst the staff. This combined with the additional problem of the inadequacy, reliability, and scarcity of software, made it remarkable that the teachers were attempting to use the microcomputer at all. Then there was the problem of transporting and setting up equipment, particularly for schools situated on more than one level. Difficulty had been experienced by teachers from the Chiltern area in acquiring places on relevant courses, but this was not so evident in Cumbria. Although, teachers from the latter area were not so keen on attending these courses as those from the former. Response to the question relating to courses from the Curriculum Award schoolteachers was poor, and the few teachers who did answer the question stated that they had had no difficulty in getting places on such courses. But, overall the lack of training and time allocated to carry any training out was a major problem. One teacher even stated that because they did not have a teacher proficient enough to use the microcomputer they had handed it over to the junior school.

The problems relating to girls not being interested in using the microcomputer was barely evident. Only one school from the Chiltern area specified a difference in approach of the sexes when using it. They had noted that the boys rushed and tried out everything, while the girls had a more thoughtful approach. A response from a Cumbrian teacher even stated that girls were keener than the boys to 'have a go' and had asked to use it at break times.

General Comment

There was less interest shown in the use of the microcomputer in education in the Curriculum Award lower schools than in lower schools from the other two areas. Besides the response being poorer

from these Curriculum Award schools, the ones who did respond omitted answering quite a number of the questions.

Further details:Questionnaire and Summary Table:

Chiltern area lower schools-Appendices C1,C2,C6

Cumbria lower schools-Appendices C1,C2,C7

Curriculum Award lower schools-Appendices C1,C2,C8

The middle schools were then posted questionnaires.

QUESTIONNAIRE C:MIDDLE SCHOOLS 1984

Result.

	Chiltern Area.	Cumbria.	Curr.Award.
%Response	62	85	80
Av.no.micros. per school	4.4	3	2
No.of pupils per micro.	146	170	250
% of BBC'S	86	57	81
No. of schools without micros	0	0	0

USAGE/NON-USAGE

Overall, the microcomputers were not being used to capacity in these schools. Responses included phrases and words such as-'intimidated by the hardware', 'suspicious', 'ignorance', 'a feeling that you have to be a genius to use it', and 'a barrier exists between those who are pro-computers and those who are anti-computers'.These responses all pointed to the lack of staff training. Other remarks such as-'better to spend money on text books than spend it on an unknown quantity', 'take it or leave it', 'not

really appropriate to the curriculum', 'some regard it as another chore and a new gimmick', and 'lack of interest' were made. While these remarks still revealed a lack of training, they also revealed a reluctance to using the resource because they were very critical of its value in the classroom. One teacher denounced its use very strongly by stating,'On philosophical grounds, microcomputers constitute an immoral force in modern western society. The children should be doing something active instead of sitting looking at screens'. But, what the immoral force was, was not expanded. Another barrier proved to be the lack of time arising from the set time table operating in these schools. This combined with the time taken transporting and setting up equipment proved a real setback. Although the Chiltern area had the greater number of microcomputers per school than the Cumbrian schools, a greater proportion of the latter schools were making use of the microcomputer every day in the classroom. The Curriculum Award schools were very discriminatory in its use. Besides uncomplimentary remarks in general made about the use of the microcomputer, all the groups listed assets associated with it, such that its use developed children's thinking skills, and it being an exciting and stimulating resource etc.

Software

All these middle schools displayed a discerning approach to using the software. Although the general opinion was that it was slowly improving, scathing remarks pertaining to it were recorded from the Cumbrian and Curriculum Award schools. The MEP material was very much in use, but simulations and adventure games were also being introduced, mainly in the Chiltern area and Cumbrian schools. Some teachers in the Chiltern area were making use of the MUSE software library for obtaining software.

Problems

The problems relating to insufficient and inadequate software, lack of interest in and training for staff, and the shortage of microcomputer equipment, were common to all these middle schools. The usual problem associated with cassette loading was being experienced. A major problem derived from the way the schools had been planned. The majority were located on various levels, hence the problem of transporting equipment, accompanied by the time taken setting it up, proved of major consideration when deciding to using it. Some teachers considered the time taken to supervise children using the microcomputer an additional burden. The teachers from the Chiltern area were experiencing difficulty in acquiring places on relevant computing courses.

The difference in attitude between the sexes to the use of the microcomputer was becoming noticeable with the children in the schools in the Chiltern area and Cumbria. It was thought to be barely so in the Curriculum Award schools. The main conclusions reached were that the girls needed encouragement initially as they were rather backward in using the microcomputer and were often happy just to watch. Some responsibility for this could lie with the parents, considering that the reason given for the girls reluctance was because it was most often the boys who already had one at home, and so were already familiar with it. Alternatively the reason why girls did not have one at home may have been because they had not expressed any wish to receive one. Single sex groups were found to help, otherwise the boys dominated the equipment. It was noted that once the girls got started they became interested and were equally able in using it as the boys. One response given was that the brighter girls were more interested, but no mention was given as to whether the same applied to the boys. This could lead to the conclusion that this teacher considered all boys were bright, thus

endorsing the premise that teachers are often responsible for inculcating the idea to girls that they are not as bright as the boys. In common with the other type of schools, these teachers had found that girls did not like playing games on the microcomputer, so boys were the predominant members of the computer clubs. It was also recorded that girls enjoyed the group situation which gave them more confidence, while the boys liked individual activities and experimentation.

General Comment

Overall, the teachers from these middle schools, although having more equipment than the special and lower schools, did not show the same keeness in using it.

Further details:questionnaire and summary tables.

Chiltern middle schools-Appendices C1,C2,C9.

Cumbria middle schools-Appendices C1,C2,C10.

Curriculum Award middle schools-Appendices C1,C2,C11.

The preparatory schools were also posted questionnaires.

QUESTIONNAIRE D: PREPARATORY SCHOOLS 1984

Result.

	Chiltern Area.	Cumbria.	Curr.Award.
%Response	40	40	*
Av.no.micros. per school	2.5	1	
No.of pupils per micro.	80	85	
% of BBC'S	60	100	
No. of schools without micros	0	0	

* none included as none were listed.

opinions were expressed as quoted: "To much hassle setting up, combined with the specialised knowledge required", "Some teachers very keen-others think it is an expensive gimmick", "Older teachers very anti-computer", 'Unable to improve on traditional classroom methods due to lack of software", "Why use them?", "Not many have the conviction, interest or time, also facilities do not lend themselves to full size classes and half classes not viable for timetabling to suit the small number of machines".

The Curriculum Award upper schools were not so critical, but they appeared disinterested. This despite the large numbers of microcomputers allocated to these schools.

Software

Commercial type software was the predominating type used throughout. The teachers were extremely critical of the educational software available. File processing and word processing packages were very much in use. Some schools in the Chiltern area were starting to use Prestel, the British Telecommunication's viewdata system; also the PASCAL and LOGO languages were being introduced to replace BASIC.

Problems

The lack of suitable software was repeatedly stated. Both the shortage and security of equipment and the pressure of usage presented problems. The need for technical assistance in schools which had a large amount of equipment was beginning to be realised. The siting of equipment was creating difficulties. Either the need for a special room was expressed to overcome the transportation problem, or if the school already had a room allocated, the classrooms were often widely dispersed. The time wasted for pupils to reach the computer room was stated as one reason for deciding

against using equipment at times. This reason, combined with a lack of interest from staff and their unwillingness to train, presented further reason for equipment not always being used. Some teachers were quoted as being initially interested but soon lost interest after once or twice using the software that was available. The problem associated with staff not being suitably trained was more prominent in Cumbria than in the Chiltern area. Schools which had obtained more than one make of microcomputer were experiencing incompatibilty problems.

Gender Differences

The sex difference in the attitude to using the microcomputer was being experienced by all three groups of schools. It was generally expressed that the girls had less confidence and needed encouragement and that all-girl groups were required in order that the boys did not commandeer the equipment. One response stated that the girls had difficulty with logical thought and found using the microcomputer much harder than the boys did, and they also got frustrated easier than boys. Other teachers stated that the girls used the microcomputer for project coursework, but did not seem to be interested or get pleasure from using it. While in partial agreement with the latter statement, and that referring to girls requiring encouragement, experience has revealed that the girl's approach to using the computer has shown more logical thinking than that of the boys. It was considered that the problem associated with gender had been lessened by those schools not offering computer studies at GCE level. By replacing it with new commercial type topics, the girls were noted to be more interested. But this could simply reinforces girls' acceptance of traditional roles, rather than searching for methods designed to break them. The girls were generally found to like using application packages rather than

Usage

Little interest was shown in the use of the microcomputer in the classroom in these schools; they were not in full usage. A response from Cumbria expressed that the use of the microcomputer should be limited to secondary schools only, as they were rarely used properly in the lower schools. An opinion from a girl's only school stated that it was important that girls should use the microcomputer, but simply because of the office now being computerised. Traditional roles were still, apparently, being inculcated with these girls.

Software

The BASIC programming language was being taught in both groups of schools. In the Chiltern schools, commercial software was being used in the form of file-handling and word processing packages. There was hardly any mention of the software in use in Cumbrian schools, the exception being a 'sort' program.

Problems

These were the usual ones relating to lack of equipment and software, combined with the difficulty of transporting equipment around.

These schools were behind the state schools in the use of the microcomputer in the classroom.

Further details:questionnaire and summary tables.
Chiltern preparatory schools: Appendices C1,C2,C12.
Cumbria preparatory schools: Appendices-C1,C2,C13.

Details resulting from the questionnaire posted to the upper schools follow.

QUESTIONNAIRE E. Upper Schools 1984.

Result.

	Chiltern Area.	Cumbria.	Curr.Award.
%Response	78	81	33
Av.no.micros. per school	16.2	10.5	20
No.of pupils per micro.	56	95	45
% of BBC'S	75	41.2	48
No. of schools without micros	0	0	0
No.'A'Level entries	31	4	4
% entries:girls	29	50	0
No.'O'Level entries	803	360	125
% entries:girls	40	41	35

Usage

Some schools were no longer offering Computer Science/Studies as examinable topics and were introducing commercially oriented computer courses in place of them. A general computer awareness course was often being offered to all pupils. The TVEI course was running in the selected TVEI schools. While a large proportion of the staff were making use of the microcomputer in the teaching of their subject, the more mature staff members were reluctant to use it. The teachers from the Cumbrian schools were more critical in their approach to using it. Apathy, tolerance, fear, and sceptism were all expressed relating to its use in these schools. Further

writing their own programs.

Further details: questionnaires and summary tables.

Chiltern upper schools-Appendices C14,C15,C16.

Cumbria upper schools-Appendices C14,C15,C17.

Results from the questionnaires posted to the independent schools follow.

Independent Schools 1984

Result.

	Chiltern Area.	Cumbria.	Curr.Award.
%Response	71	*	33**
Av.no.micros. per school	8.2		12
No.of pupils per micro.	50		***
% of BBC'S	44		17
No. of schools without micros	0		0
No.'A'Level entries	12		0
%entries:girls	83		5
No.'O'Level entries	71		5
%entries:girls	67.6		100

* no response

** one girls' school only

*** roll not provided

Usage

Only one Curriculum Award school out of the three contacted, returned a completed questionnaire. This poor response, combined with the fact that many of the questions were left unanswered, meant that little could be gleaned from this reply. Disinterest in the use of microcomputers in the classroom could be assumed. The school which answered had a low number of computer examination entrants. The general disinterest in computing in these schools may also be assumed in consideration of the fact that no returns were made from the schools in Cumbria. One response from a school in the Chiltern area about the use of the microcomputer in the classroom was that "It was alright as long as it did not infringe on the 'more important' traditional subjects".

Software

Again, as with the upper schools, commercial type software was being used in these particular schools in the Chiltern area. BASIC was the only language in use.

Problems

Problems relating to lack of confidence amongst the staff were cited. Because the pupils using the microcomputer treated it as a form of game, this was also cited as a problem. It could be associated with its assets; the games approach to education is considered possible when using the microcomputer, and is one of its major attributes.

Only one school offered G.C.E. courses at 'A' level in Computer Science, and the number of girls attending this course comprised 83% of the total. Also a high number were attending G.C.E courses at 'O' level. Although a girls-only school was included in the 'O' level totals, this school had 30 girls out of a total of 500 on the school roll on this course; a higher average than normal. Another mixed school had 18 girls on the 'O' level course but only 14 boys.

Further details: questionnaires and summary table:

Chiltern independent schools-Appendices C14,C15,C18.

Curriculum Award independent school-Appendices C14,C15,C19.

A summary of the information obtained from these questionnaires is contained in the findings from the 1984 research. In order to ascertain whether the actual situation in the schools corresponded to that gleaned from the questionnaires, visits were also made to schools in the Chiltern area.

Visits:Chiltern area, Summer Term 1984

Overall 27 schools in the area were visited and the progress that the teachers were making in implementing the microcomputer in the classroom noted. Strike conditions prevailed, and computer clubs had been cancelled. In some cases the effort to use the computer in the classroom had diminished.

Visits:Lower schools 1984

No. visited:9

Staff Reaction

Teachers who had attended the LEA Induction Course, were becoming more confident in using the microcomputer than they were prior to attending the course. Other teachers were still very unsure, so they were being advised to take the computer home to familiarise themselves with it. This proved the quickest way for them to get over any inhibitions relating to its use; the microcomputers were fully insured for this reason. Despite this, many teachers still lacked confidence. For example, a class was working on a project about dinosaurs, but the teacher, when approached about using the database type program Factfile (9), which contained a file about dinosaurs, felt she could not possibly use the microcomputer until

she knew more about it. Teachers who had even the slightest knowledge of computers were highly valued. It was beginning to be realised that in order to fill a post for a teacher who was proficient in the use of the microcomputer in education, the position had to be a higher scale post. Children were observed on one visit using a table test type piece of software. This had been written by one of the pupils, a boy of seven. This boy explained very succinctly his method of writing the program. The teacher was constantly being told what to do when using the microcomputer with the class, by this pupil. In general, much reliance was placed on pupils in the class to put teachers right whenever they got into difficulties when using the machine.

A suggestion was put forward by one headteacher that teachers from the various schools should get together more to decide just what to do with the microcomputer and see how each school was using it. Teachers were bewildered at how to use the machine having one for perhaps 300 children, and this was coupled with the fact that they had not received any direction as to what to do with it. They were dismayed that they were expected to use it without knowing how to, but even more dismayed at finding that they were not allowed to get to know. They were tired of applying for courses and being told that they were full.

The importance of example and encouragement from headteachers in these matters was revealed when one headteacher was not at all interested in the use of the microcomputer in her school, although she had obtained one. This feeling had permeated to many of the staff as one member who was very keen found she had the use of it whenever she wished because the remaining members did not use it.

Method of Usage

It was often considered better to prepare first before using a

program on the microcomputer. Children were observed planning and writing out their input first before using a particular MEP Primer Pack (4) program. This alleviated the problem of having one machine for many children. Another method of relieving this problem, albeit perhaps unwisely, was the practice employed in one school where the head considered the reception class of five year olds were too young to be using it. Group usage also helped the situation rather than individual usage. Another method employed was to allocate the microcomputer to each classroom for a certain number of weeks at a time. Use as an electronic blackboard, created viewing difficulties.

The notion that the children looked on the work that they were doing on the microcomputer as a game was frowned upon. Being concerned about evaluation, records of children's tests in the area of computer vocabulary were being kept. With other subject areas, tests are set out so that the teacher has an insight into what the children are supposed to be learning. The use of the microcomputer for individual tuition was found to be useful for those children who had not attained as high a standard as the others. It was observed being used in this way in order that some children could assimilate some form of numeracy or literacy before moving on to a middle school.

An interesting fact which transpired from one visit was when a group of three children were using the microcomputer towards the end of the afternoon, while it was story time for the rest of the children. The three children were not concentrating on what they were doing on the microcomputer but clearly wished to join the other children and listen to the story that the teacher was reading. This was rather surprising as on other occasions children often argued about whose turn it was to use the microcomputer. This observation showed that having a story read to them was still higher on their

list of enjoyment than using the microcomputer. It may also reveal the inkling of the possibility that the motivation created by using the microcomputer in education may be temporary.

Gender Difference

Some first year pupils were using the computer in small groups, mainly for number recogition and pictorial counting. The children were aged five and six, and the girls were inclined to be rather more bossy in their approach to using the computer than the boys, and were quicker at responding to the various tests imposed by the software, and the boys were never allowed by the girls to have a first 'go'. In general the girls had much more to say for themselves than the boys and were pressing the keys impatiently when it was the boy's turn to answer and they considered that the boys were taking too much time to do so. One girl was very confident and was remarkably 'quick' but the teacher explained that she had previously attended a private school. The teachers at this school said that they had not really seen any great difference in the approach of the boys to that of the girls and that the girls definitely came forward as much, and even more, than the boys. They also said that this did not just apply to the use of computers, but that the boys were ready to come forward to take part in subjects which were once role-allocated, such as cooking. Observation of a group of children in this age group using the microcomputer endorsed the view that the girls were more confident than the boys. On another occassion a program was being used which presented a task consisting of a number series guessing type of exercise; the girls were more careful in deciding what the next required number in the series was, but the boys guessed haphazardly.

The situation became different in the children's last year at the lower schools. Those attending a computer club run for pupils in

their final year, were mainly boys. An opinion given on this matter was that although girls were not very forthcoming in using the microcomputer in the final year, it would prove to be a temporary situation; when the girls had been using it from the first year at school it was considered that the backwardness would eventually cease.

Equipment Siting and Setting up

The corridor was being used in one school to solve the problem relating to the siting of the microcomputer. The teacher sent pupils, of the same sex, out two at a time, unaccompanied by the teacher, to use it for a specific time. Girl monitors were responsible for setting up equipment and loading programs. These monitors also demonstrated programs to teachers who were unsure of how to use them. Security of equipment was another problem emerging, particularly with those schools situated near to a town centre. The problem lay in where to keep the microcomputer in order that vandals breaking into the school would be unable to find it.

Software

The MEP Primer Pack (4) was often the only software in use. The program Animal (10) was a favourite piece of software in a number of schools. A few schools were using the concept keyboard with software. The combined radio and introductory program pack, Using Your Computer (11) had been found to be useful as an introductory aid.

The main observations arising from these visits lay in the way the pupils were advising the teachers, and despite the clearly evident, lack of knowledge, how the teachers were striving to use the microcomputer. The middle schools were also visited in the summer term.

Visits: Middle schools 1984

No. visited:9

Staff Reaction

While these teachers appeared to show less interest than their lower school colleagues, it may have been because the time factor was more pressing for the middle school teachers having a syllabus to follow. They showed the same lack of training in the subject and were equally unsure of what they were supposed to do with the microcomputer as were the lower school teachers.

Method of Usage

Attempts were being made to use the microcomputer as an electronic blackboard with a complete class by using a large television screen. The teachers found it difficult to organise using the microcomputer for group work in these schools. With more equipment being purchased, some schools were allocating or considering having, a special room for the microcomputers; they considered that besides alleviating transportation difficulties it would enhance the use of the microcomputer for a complete class if more monitors where available. Mainly though, the use of the machine as an electronic blackboard had to be abandoned because all the children could not see the single screen. But the microcomputer used in this way, in demonstration mode, is of value. Many routines that are time consuming to draw on the chalkboard or that require many calculations to be carried out for a simulation make excellent use of the machine. Middle schools do not carry out as much group work as the lower schools but pupils were sometimes put in groups of ability to use the microcomputer. Computer appreciation was often timetabled, each child having a specified number of lessons.

Control

There was no evidence of the microcomputer being used for control

purposes. Little use had been found for the BBC Buggy robot; it had been relegated to a cupboard in one school. The teachers were quite interested in seeing how it performed. The question then was what they did with it next. They required advice or suggestions on how to make some use of it and this had not been forthcoming. Other teachers approached about the use of this robot considered it was too expensive and that it really needed older pupils in upper schools studying control technology to make use of it. Some had made cheaper versions for project work.

Equipment

Generally there was an increase in the number of microcomputers in each school, also in half of the schools discs drives and printers were in use. The schools which had started to make use of a word processing package had realised the need for a printer. One presumably affluent school, which had been using computers for a few years, had about ten microcomputers, disc drives, a printer and a voice synthesiser with a special room for using the equipment; pupil monitors were responsible for setting up the equipment as required. Overall, microcomputers were being used more than in the previous year. In schools where the emphasis had been on buying equipment with little software, the problem had been in trying to find a use for the equipment. A specific teacher was often being delegated to be in charge of computer resources. A Sirius microcomputer was being used in one school as part of an LEA project to test the use of this machine in schools for administration purposes. The possibility of middle schools being able to afford such a machine was nil, even if the project proved to be successful.

Software

Computer Appreciation consisted of ensuring that the pupils were able to use the computer, load tapes and discs and work through the

Welcome pack (14) for the BBC microcomputer. After that they were introduced to the idea of a database type of software by using the Tree of Knowledge program (12). Quest (2) was sometimes considered a little difficult for this age group. Some schools introduced the pupils to very simple BASIC programming. Much use had been made of the MOVES (5) and DART (1) software. The lack of software for middle school science was remarked upon. The MEP Input Pack (8) was used but much of it had found to be irrelevant for middle school use. The combined radio and computer pack, Using Your Computer (11) had also been found useful in these schools for introducing staff and pupils to the microcomputer; two hundred out of the three hundred children at one school had used the pack, but only if they had wished to. Mathematic programs were used by groups of children to reinforce topics where they had experienced difficulty. An interest in programs for designing embroidery was expressed.

Gender differences

The girls were showing more interest than they were when a particular school was visited a year previously ; this was said to be due to using a wordprocessing package. The older girls were very interested. The boys were still inclined to push the girls out so computer club periods had been assigned for girls only. Boys were very keen on playing games, but they were also more interested in programming than the girls. The girls were more interested in the database program and the LOGO type programming than BASIC. The boys preferred BASIC.

Middle School Use of PROLOG

A middle school in the area was taking part in the Leicester micro-PROLOG with graphics project, Ball (1983); this software was not functioning correctly on the day the school was visited. This PROLOG with graphics project, investigated the use of PROLOG in the

classroom with pupils aged between eleven and fourteen. Graphics were added to micro-PROLOG for the RML 380Z microcomputer by appending machine code routines to implement 'turtle geometry'. The software package, which was tested by four middle schools, either made use of the microcomputer as an 'electronic' blackboard, or for group interaction, and also provided a more user friendly environment for writing micro-PROLOG programs. The project ended in August 1985 and a final report has been promised to be available in the near future (September 1985).

Problems

A major problem in these middle schools proved to be one of mobility as they were mainly built on more than one level. The microcomputers had to be locked away in cupboards for security reasons. One school had had a special lockable cabinet built to house the microcomputer equipment. Another problem had arisen where children were mainly Asian. They had to attend the language centre first in order to be able to speak and write English, so any use of the computer in lessons had to be carried out extremely slowly. A school was visited which had a very large number of Asian children on the roll and the microcomputer was hardly used. The teachers were not very interested even though one member of staff, who had obtained the Certificate of Further Professional Studies had provided a course in educational computing for them to attend.

While the ammount of equipment in these schools was increasing, its usage was not increasing significantly, and the teachers were less interested than the teachers from the lower schools. Details from the upper schools, which were also visited, follows.

Visits:Upper Schools 1984.

No. visited:5

Staff Reaction to Using Microcomputers.

Although the use of computers in these schools was not new, there was still, on average, about three quarters of the teachers who did not wish to use it in teaching.

Equipment

All the schools were much better equipped with hardware than the middle and lower schools, but particularly the one which was a TVEI(1984) school. BBC microcomputers were used for teaching purposes and the installation of network systems was being considered. Computer equipment was mainly centralised in a special room.

Usage

With the exception of the TVEI school, G.C.E.'O'and 'A' level in computer topics were still being offered, but the teachers were unsure about continuing them. The TVEI school was more interested in the 16+ Information Technology and Control Technology course. While BASIC was still in use, a change to LOGO and PASCAL was being considered. Pupils taking the G.C.E.'O' level were found to have great difficulty in completing the programming part for the required project. A number of pupils from these schools had attended a micro-PROLOG course for sixth formers, but while the students had been interested at the time, they had not followed it up to any extent on returning to school.

Gender differences

The number of girls entering for examination courses was, on average, about one third of the total, but with the higher proportion being entered for the 'O' level grade. The girls were not

interested in the computer clubs, or in using the microcomputers except for the project work. One girl was very interested in doing more PROLOG at university.

Upper School Use of PROLOG

A sixth form course to introduce micro-PROLOG to these students was held in the Chiltern area in February 1984. Besides introducing micro-PROLOG the aim was also to explore how it could be used in the following subject areas: Economics and Business Studies, History, Environmental science, Physical science, and Mathematics. Tutors in these subject areas were also present. Some of the students had no previous knowledge of computer programming and this seemed to help them in accepting micro-PROLOG readily. The girl mentioned above, who was particularly interested, had not liked programming when she had been introduced to it previously through BASIC.

The schools involved were allowed to copy the software, which was for the RML380Z. Visits were later made to these schools to observe how the students were using the language in their particular subject areas. This showed that while the course had been very successful, there had been little follow up. Reasons were due to impending examinations, no direction on returning to school, students on the brink of leaving, and the RML 380Z not being available for student's use at these schools. These machines were being used for administration and the BBC microcomputers were provided for use by the students. More direction would have been possible if the course had been planned differently. Teachers were not working with pupils from their own schools while on the course, hence on return to school the teachers had formed an interest in certain projects but their pupil's interest lay in other projects.

The microcomputers, although increasing in number, were not being

used throughout the curriculum in these schools. This was not found to be so in the special schools visited.

Visit:Special Schools 1984.

No.Visited:4

Staff Reaction to Using Microcomputers.

Staff were keenly interested but unsure, and the problem relating to the training of staff in the use of microcomputers in education prevailed.

Method of Usage

These schools rarely made use of the microcomputer as an electronic blackboard; the pupils were not taught as a whole unit as they needed individual attention. Because of this, more and special equipment was required, e.g.for non-vocal pupils who did not have enough hand control to use a standard keyboard. The microcomputer was also used in the nursery sections of these schools.

Equipment

Although still insufficient, these schools had more microcomputers than other schools and more advanced peripheral accessories. This was due to the generosity of private individuals and organisations. Light pens and joysticks were in use, and in one of the schools, a mouse was used for the children to experiment with colour and shape. Much use was made of the concept keyboard; the teacher responsible for computing in one school was making all the software for entry via the concept keyboard. A very inexpensive concept keyboard was in use which consisted of actual coins of the various denominations glued over the concept keys, enabling the pupils to handle money transactions.

In one deaf unit the children were working in groups using the microcomputer and were communicating freely. Their teacher said that

they communicated more when using the microcomputer than they did ordinarily, providing the software motivated them. This was considered one of the most difficult tasks to accomplish with deaf people.

Siting

One advantage that all these schools had was that they were situated on one level to facilitate wheel chairs, hence enabling easier transportation of microcomputer equipment.

Gender Differences

No difference in the approach of the boys and girls was noticeable nor had their teachers noticed any.

Software

Software was not sufficiently geared to the needs of these children and many children did not understand the language used.

The greatest advancement in the use of microcomputers in schools was to be found in this special education section, but more specialised software was required, and even more specialised hardware. Details recorded from one independent school visited follows.

Visit:Independent School 1984.

This particular independent school was visited for critical case analysis; a public school which had been using computers for some years, initially using a mini-computer with terminals connected, and had actually built a small computer in past years. Although they had used one of the very first microcomputers produced, they were using BBC microcomputers and were pleased with them. One reason given was to be able to use software written for other schools. The school had used computers in the past mainly for number crunching but at

the time of the visit all sections of the school were concentrating on facilities offered by the BBC microcomputer, such as Prestel, Ceefax, wordprocessing and data handling software. The pupils used wordprocessing software to write their own magazine. The staff used the microcomputer for other subject areas too, particularly Geography. Whilst the school offered G.C.E. at 'A' level in Computer Science, it was considered to be just an additional 'A' level. This meant that the students taking it were studying for four advanced levels. The teacher said that in the past the students had done quite well in the Computer Science 'A' level examination, but with the syllabus changing to include commercial oriented topics and examination questions which had to be answered in a discursive fashion, they were no longer achieving good grades. While BASIC was used, this was a temporary measure, and the teacher did not see its value for logic thinking, considering that the logic was hidden from the user.

This school consisted of preparatory, middle and upper sections, so the microcomputers, being used by all three, were dispersed around the buildings and networked using a Winchester disc. The staff were rather sophisticated in their computer usage, and the choice of BBC microcomputers was rather surprising. The move towards using commercially oriented types of software was instigated by a mathematician.

These visits showed that a lack of teacher training in computer education was still evident in all these schools and re-inforced the conclusion, relating to this fact, drawn from the information obtained from the questionnaires. To enhance the findings further a number of telephone interviews with teachers were carried out.

TELEPHONE INTERVIEWS 1984

37 Schools in the Chiltern area were contacted by telephone:

(a) where it had been supposed that the schools had still not obtained a microcomputer and,

(b) where it had proved difficult to carry out a visit.

No previous contact had been made with nursery schools but it was considered necessary to gain an insight into the situation relating to the use of the microcomputer in these schools.

Telephone Interviews:Nursery Schools 1984

No. contacted: 8

None of these schools had a microcomputer but 50% were interested in using one for record keeping.

The major reason for the telephone contact to the lower schools was to ascertain reasons why they were not acquiring a microcomputer.

Telephone Interviews:Lower Schools 1984

No. contacted:10

The schools selected were not expected to have a microcomputer, and with three exceptions this was so. The reasons given were because the schools were either in a poor area or were small schools in rural areas. There was also a lack of interest, and it was suggested that this was because the staff were often middle aged. Another reason for not wishing to purchase a microcomputer was a lack of expertise, but it was hoped that when teachers had been on the Cascade Scheme, run by the LEA, they would feel better prepared to think about obtaining one. Two schools who had a microcomputer did not wish to be visited because of the industrial dispute.

Telephone Interviews:Middle Schools 1984

Only one middle school was contacted by telephone because of visiting difficulties and the pattern of usage in this school followed that of other middle schools visited.

The upper schools contacted were those where pupils had attended the sixth form micro-PROLOG course, but had not already been visited.

Telephone Interviews:Upper Schools 1984

No. contacted:11

In a similar manner to those schools which had been visited, little follow up had transpired on the pupil's return to school after attending the course. The teachers were also briefly questioned about the use of the microcomputer in general in their schools, this followed the same pattern as in the upper schools visited at this time.

Most of the special schools in the area had already been either issued with a questionnaire or visited. The two exceptions were contacted.

Telephone Interviews:Special Schools 1984

No. contacted:2

The teachers were very keen to help. The concept keyboard had been found to be very useful but it was considered that a speech synthesiser was really required. One of the schools was well endowed with equipment, besides BBC microcomputers and Electrons, they had two Apples, a Mackintosh, and an ICL Personal Microcomputer. This school was to be a County Resource Centre. The teacher in charge of resources was very impressed with the software, Granny's Garden (13); he considered it excellent, saying how the pupils usually got fed up with a piece of software after 20 minutes but that they had

used this software for hours.

The independent schools selected were mainly just starting to purchase BBC microcomputers and setting up courses.

Telephone Interviews:Independent Schools 1984

No. contacted:5

Two of the schools were offering G.C.E. at 'O' level on Computer Studies, and one was offering Computer Science at 'A' level. With the exception of one school, they were gearing computer appreciation courses to commercial usage using word processing, database and information retrieval packages.

Findings:1984

At the end of 1984 most State schools had at least one microcomputer. The exceptions were the nursery schools and those schools in poor areas and small schools in rural areas. The teachers were still experiencing problems due to lack of training and direction, and mobility of equipment. Much reliance was placed on pupils, particularly in the lower schools. This was a very pleasing situation to observe, particularly as these teachers clearly did not mind asking the pupils to help them. The Cascade scheme for training teachers had been initiated for lower schools in the Bedfordshire area. It was clear that if the headteacher was not interested in the innovation, the rest of the staff generally would not be.

The major advancement in the use of microcomputers in education was in the special education sector, particularly in the schools for the physically handicapped. Observation in these schools revealed the need for more equipment. Observing the use made of the microcomputer by these physically handicapped children also made the statement that all that was not measurable, from an educational viewpoint, valueless, a debateable point (Holt 1981). Another

promising area was in the lower schools. These teachers seemed more aware of the use of the microcomputer to enhance their teaching than teachers in the middle schools. Even though the middle schools had purchased additional equipment they were not using it to the same extent that the limited equipment was being used in the lower schools. But the lower schools have a more flexible time table and teaching methods that adapt well to using the microcomputer. One main objective still lay in getting all the children in the school using the microcomputer, however minimal. The privately maintained schools were generally falling behind the State schools in developing the use of microcomputers in their schools.

Entirely new courses for upper schools were being formulated which emphasised the connection between the individual and modern technology. These were starting to replace G.C.E. and C.S.E. courses in some schools. The software used associated more with the commercial world. Software used by the schools for the lower age range was mainly that provided by MEP and the LEA, particularly Dart (1), Factfile (9) and Quest(2). The value of word processing packages was beginning to be realised. Attempts made to introduce PROLOG into schools in the Chiltern area were having little success. While the course to introduce sixth-formers to micro-PROLOG had been successful there had been little follow up to it on the students return to school. But, these students had taken to it more than the teachers on the course the previous year.

Girls were noted to be more confident in using the microcomputer, initially, than boys in the lower school, but the boys became the more confident ones towards the last year in the lower schools. This situation continued when they transferred to a middle school. The new courses in the upper schools were attracting the girls more than the previous G.C.E. and C.S.E. courses in computer topics. But this

was because the new topics related more to the traditional stereotyped female roles.

The Chiltern area was seen to be further ahead in its use of microcomputers in schools than the schools in Cumbria and the curriculum award schools. This was understandable considering that attempts to accomplish this started as early as 1963. The special schools in the Chiltern area were also faring better for equipment than those in Cumbria. The latter schools were rather more critical users of the microcomputer. The Cumbrian lower teachers were more critical of the software situation than the teachers from the lower schools in the Chiltern area, and were not as ready to use it. Also they were not as eager to attend in-service courses in computer education. The response from the curriculum award lower schools was comparatively poor. Those that did respond were also more critical of the software situation than the teachers from the Chiltern area, and were using the software that was available, less than schools in either of the other two areas. There was no evidence of any links to the computer industry with these schools.

Teachers experiencing a shortage of equipment and software, and having received no direction about how to use the equipment, were in a state of bewilderment regarding what to do with it, particularly in the lower schools. Given these general conditions the microcomputer could hardly be expected to be used, in these lower and middle schools, in a way other than that which followed the traditional method of teaching and learning. The majority of teachers viewed the microcomputer as simply another educational resource and there were no indicative changes in teaching practice in 1984.

RESEARCH 1985

By 1985 it was possible that the middle period in the life cycle of the innovation was approaching. Hence the various grades and types of schools in the Chiltern area were contacted in the Summer term of 1985 by telephone in order to get a brief appraisal of the then, current usage of microcomputers in each establishment.

Summer Term 1985

It was considered that, possibly, microcomputers may be in use in some nursery schools; hence the contacts.

Nursery Schools 1985

No. contacted:11.

Of those contacted, none were using a microcomputer, although one of them was going to be given the loan of one for experimental purposes. Financial reasons were a major hindrance to these schools not having microcomputers, but other reasons were presented. Eight of the teachers considered that a microcomputer was not the resource for use with children of that age group; they would not even consider having a television in the school as they were of the opinion that the children spent enough time in front of a television screen at home. They thought it better that the children were active. They seemed to be under the impression that having a microcomputer in the room would entail the children sitting in front of it all the time. Also they considered that when the children had such a short time in that type of school, and there was so much for them to do while they were there, they would have difficulty fitting in the time to use a microcomputer. Five of the teachers were interested in using a microcomputer for record keeping and other administrative purposes.

The following schools contacted were mainly those previously contacted.

Lower Schools 1985

No.contacted:7

Four of the schools contacted, which did not have a computer last session, had since obtained one. Other schools were gradually increasing the number they had, and were either buying, or planning to buy, disc units and printers. The initial wariness amongst staff about the use of the microcomputer in schools, had been considered a good thing by some staff. But most of the staff were coming round to accept it and the microcomputers were said to be in constant use. In fact the teachers said they could make so much more use of them if they had more as there was such a demand for their use, but they were constrained with often only having one or two for so many children to share. Schools were relying on parents to enable the purchase of further equipment.

In the Chiltern area in the 1984-85 session, the emphasis was on helping the lower school teachers; the Cascade scheme was in operation in Bedfordshire to introduce teachers to the software that was available and how to use it. Software evenings were held where the teachers could look at software and copy programs that the LEA had obtained a licence for. Generally there was much more software available in the lower schools than in previous years, and the teachers were being more selective. Some felt that more help was needed, and that they were still just being left to 'get on with it', saying that, at the courses they had attended, all they did was to look at software but did not get any training in using the machine.

One interesting development was parents actually going into the schools and helping with the use of the microcomputer; some of the schools had been fortunate in that some of the parents had a knowledge of computers, albeit they were often too busy during the day to help much. But, a more interesting situation was mothers helping the teacher with groups of children using the microcomputer and the teachers said that the mothers were getting quite involved. Some schools had appointed pupils as monitors who were responsible for setting up equipment ready for use; in one school they had particularly selected girls for this task. One main method of use was to timetable the use of the microcomputer to enable every child to use it. Some of the schools were beginnig to use adventure games and word processing packages in the classroom. While the teachers stated that they did not see any difference in the approach of the girls to the boys in using the microcomputer, one said that the girls were so much better at using it than the boys.

The teachers mainly considered that the microcomputer was not revolutionising teaching and learning methods and that it was only used to reinforce traditional teaching methods. Some did say that through using the microcomputer some topics were beginning to be looked at in a different way, but they said it certainly was not a prime teaching aid. One teacher considered that a break away from traditional teaching methods had already occurred in her school, but also stated that it would have occurred without the introduction of the microcomputer. Another opinion was that the 'seeds of change' were there in the way teachers were using the microcomputer in the classroom. Generally the teachers considered the microcomputer an additional resource, just for reinforcement, and involving no revolutionary techniques at all, although some teachers thought it early days and that the situation may eventually change. While

attempting to bring about discovery learning, many teachers had realised, that contrary to Papert's claim (Papert 1980) that children can learn unaided, in the majority of cases, discovery cannot be left to chance, it has to be guided. Hence the teachers used some traditional didactic teaching method.

Middle Schools 1985

Six schools were contacted. All were increasing the number of BBC machines and peripheral equipment, and many more of the staff were getting interested in using the equipment. One teacher considered that with some of them it was simply because of a guilty conscience, that they thought they should be using it but didn't really want to. One school had formed a Computer Dissemination Group when it was realised that many of the staff were keen to use the microcomputer but wondered how.

The main development, from previous years in the way that the microcomputer was being used, was that the teachers had selected a few pieces of software and were only using these. These were: Dart (1) -the LOGO 'type' software, database type-Tree of Knowledge (12) and Quest (2), and word processing software. Infoview (15) was very much in use in the English lesson with the aim of producing the school's own magazine. Interest was shown in acquiring the LOGO chip for the BBC microcomputer. Two of these schools were developing the use of the microcomputer in Control, Design and Technology. Another developing area, where there was keen interest, was in the use of Adventure games for promoting discussion, and problem solving skills. Some of these schools favoured the idea of timetabling the microcomputer to give every child a chance to use it. But one school was discontinuing this as it was realised that it was prohibiting its use in other areas of the curriculum. It was stated that

teachers were now becomimg interested in using the microcomputer yet they could not make use of it because of it being timetabled for general computer literacy use. Computer clubs were being temporarily suspended because of strike action.

As with the lower school teachers, most of the middle school teachers saw the use of the microcomputer as a back-up to general curriculum work and that while it was beneficial for this, it was not offering anything new. The teachers were being more selective in how they used it. One teacher considered that there was a change in how children were learning, but while it coincided with using the microcomputer, she considered that it would have come about anyhow.

Special schools 1985

No. contacted:4

The schools for the physically handicapped were obtaining much more equipment and software while the schools for slow learners were not increasing their resources at the same rate. Also the interest amongst staff was higher in the schools for the physically handicapped. The initial interest in the microcomputer by children who were emotionally disturbed and whose conduct was disorderly, was found to have waned. BBC microcomputers were requiring maintenance and repairs which often could not be afforded. A special school for the physically handicapped considered that they had had to increase their number of Apple microcomputers because there had not been the right kind of software suitable for special schools produced for the BBC microcomputer. Another similar school was of the opinion that while this had been initially true, much had since been developed for the BBC microcomputer so they had decided to increase their number of BBC's. The mouse had been found to be very good for many disabled children. The software was improving and SEMERCS was

proving to be a useful source of supply. Staff were still very keen and were becoming so much more confident.

Upper Schools 1985

Six upper schools were contacted. All had obtained more equipment. It was considered that the BBC machines still did all that the schools required of them, and the teachers did not foresee the need for a 16 bit machine for a number of years. Some teachers were rather intolerant at the intention of introducing these machines into schools. Others did admit that eventually they will need to change, but considered that there was so much software for the BBC, that they envisaged when a new machine was introduced, it would have to be compatible with the BBC. Problems encountered by manufacturers providing microcomputers for schools though, have left educational buyers debating over future purchases. Even if schools could change to the 16 bit machines, home users would not be able to afford them. This would make the present trend whereby much project work is carried out in the home using the personal computer, impossible. Upper schools initially used RML380Z microcomputers with the pupils but this machine had mainly been delegated for use in the office for administration.

The microcomputers were being used over an increasing number of subject areas, and also used by more staff. On average about 25% of the teachers in these schools still did not wish to use the microcomputer in their teaching. Those who did not were specified as in the older age range, rather than predominantly female. While simulation type of software was used across the various subject areas, the most commonly used type of software followed the pattern that had been in use when the schools were visited the previous year; namely word processing, information retrieval, and database

type. BASIC was still the most commonly used language for coursework, but LOGO and PASCAL were beginning to be used, albeit to a very minor extent. But being available on the BBC microcomputer, they were being considered for future use. A teacher who had attended the micro-PROLOG course was interested in using this language whenever it became available on the BBC. While the schools still offered G.C.E. at 'O' level in Computer Studies, they were mainly more interested in changing to the new 16+ course in Information Technology, one reason being because it was commercially oriented and they considered it being more geared to the needs of society. Four of them offered the G.C.E. at 'A' level in Computer Science but two were considering dropping it, the reason stated was that universities advised the studying of other 'A' levels for those wishing to apply for entrance to degree courses. An average of one third of the pupils taking these courses were girls, and the opinion was that the girls were getting more interested in the new topics, but were completely uninterested in playing games on the microcomputer.

The schools which had stated the need for technical assistance the previous year, felt the need to be even greater in 1985 with the increase in equipment, but their request had not been successful. When the possibility of intelligent tutoring systems being implemented in schools was put forward, the teachers admitted to having no knowledge of this area.This would suggest that, combined with the teacher's reluctance to change to 16 bit microcomputers, the use of intelligent knowledge based systems in schools to be some distance off.

Preparatory Schools 1985

Two schools were contacted. These schools had had their BBC microcomputer for a few months only and also stated that it had limited usage and a low priority because of the importance of the Common Entrance examination. The staff from one of the schools had considered themselves fortunate in that they had had quite a few parents who were knowledgeable about computers and who had helped. Neither of the schools had noticed any difference in the attitude of boys to girls to using the computer.

Independent Schools 1985

Four schools were contacted. Two were for girls only and two for boys only. All were using BBC microcomputers.

GIRLS SCHOOLS: One school was using microcomputers to a greater extent than the other. In this school they were just starting to offer G.C.E.'A' and 'O' level in Computer Science/Studies. They were using BASIC, but were considering using PASCAL in the future. This school was also starting to use microcomputers across the curriculum. Both were starting to use word processing packages.

BOYS SCHOOLS: One of these schools had been using computers for many years, and was still following the pattern set when visited the previous year, i.e. mainly using commercial type packages and what the master called 'real life' simulation packages. The other was starting to use commercial type software also. This school was already offering G.C.E. at 'O' and 'A' level in Computer Science/Studies, the other was just starting to offer G.C.E. at 'A' level but did not intend to offer 'O' level in computing subjects.

Findings:1985

In all areas with the exception of the nursery schools, microcomputer usage was increasing, as were the number of machines

in use and the number of staff using them. The Cascade scheme in Bedfordshire was mainly thought to have been successful in training large numbers of lower school teachers in the use of computers in education. This together with parental help was responsible for the improvement in teachers' confidence. The middle school teachers were to be the next to be offered a training scheme by the authority. The independent schools were starting to use microcomputers in the same way as the upper schools. The preparatory schools were slowly beginning to use computers. Teachers in the nursery schools showed the same reluctance to using the microcomputer in their schools as other teachers had initially shown.

While the microcomputer was still not being used in any revolutionary way in the lower and middle schools, and the teachers did not view it so, it was beginning to be used in a different way. The teachers were discarding the drill and practice type of software, and even when they saw the need for it, were often using it apologetically. These teachers seem to have been indoctrinated with the assumption that this type of software must be frowned upon. But, given good software which can match the development stage reached by the child, it can be of value. In many cases, they were beginning to use the type of software where the child learns in a more exploratory way. The 'real' LOGO was still not in use in any of these schools but much use was made of Dart (1). The adventure game type of software was increasingly being used, together with the commercially oriented type of software like word processing and databases. The BBC Domesday project (BBC 1985), was creating interest in computer databases for many schools. Teachers were getting more confident with using the microcomputer. They were beginning to consider that they were sufficiently professional to know when and how to use it, by applying careful judgement in

discerning when the need was there for its use. Also they considered that they could decide what software should be used and what should be discarded. Disdain was evident at the premise that they were not considered able to distinguish between good and bad software from an educational viewpoint. This evaluation was being accomplished intuitively rather than based on any theoretical implication.

The computer related topics being studied in the upper schools were following the commercial applications side of computing even more than they were the previous year. The termination of the G.C.E.'A' and 'O' level in computer topics in these schools seemed possible. The introduction of intelligent tutoring systems in schools would be expected to take place initially in the upper schools. But even the existence of these systems was generally unknown in the upper schools contacted.

There was still no follow through from one school to another; for example,in middle schools, in other subject areas, the teachers know the level that they are aiming that the pupils should reach before passing them on to the upper schools. This would seem difficult to define in computing topics for many reasons, the prime one being the overall lack of objectives. But now that the first policy statement on the place of computers in the curriculum has been produced by ISMERC (1985), perhaps others will follow.

The teachers were very much aware of the possibility of girls not being interested in using the microcomputer and were continuing to find ways of preventing it. This was by paying special attention to the way groups were selected when using the microcomputer and in realising that girls do not like playing games on the microcomputer and were not keen on joining computer clubs. Gender differences were slowly beginning to diminish with the introduction of new topics, but this does not directly further the cause to encourage girls into

technology.

In all areas, with the exception of the nursery schools, microcomputer usage was increasing; as were the number of machines in use and the number of staff using them.

Summary

The most surprising factor arising from this research is the remarkable rate at which the microcomputers have seemingly been accepted in the schools. In the past any changes in the educational pattern followed a very slow procedure. Initially there was a period of years between the insight into a need and the introduction of a method of meeting that need. This was followed by a number of years for the spread of the innovation. More recent studies suggest that the adoption rate is faster, particularly where there is government pressure. Few middle and lower schools were using the microcomputer three years ago and many teachers were stating categorically that they had no wish to purchase one; the change must be attributed to the DoI's offer (DoI1981). Schools felt that they could not refuse this offer of a resource at half the cost. But from then on they had to make their own decisions relating to how they were going to use it. The question of whether this acceptance of the microcomputer in the classroom will be permanent is examined in the findings section.

Selected School

One school was selected for more extended research. With other schools and colleges, the teachers and lecturers interviewed or answering questionnaires could be assumed to be those in the establishment who would be most interested in using the microcomputer. Hence, a school was selected where it was possible to have all the teachers fill in a questionnaire and to talk to various members of staff on the frequent visits. The selected school was a middle school which consisted of three sections located in three separate buildings. One was a special unit for maladjusted children, one a building for first year pupils, and the remaining part for ten to thirteen year olds. Each section had teachers specifically assigned to teaching mainly in that block.

Development

When the headteacher was first approached in 1981 about using a microcomputer in this school he was not interested, considering that there were more pressing things like books to buy. With the offer of a half price microcomputer, and ultimately attending the Middle School Induction course in order to obtain one, his interest increased although he was not overtly interested. On receiving the BBC microcomputer in 1983 two of the teachers, who had also been on the course, explained how to use it to the rest of the teachers. It was then left in the staff room for a week, together with a large amount of software. Subsequently the headmaster did not seem to want to be particularly involved with it. When the microcomputer was in the staff room, interest was shown by most of the teachers but the two female English teachers considered it was the last resource the school required. But, with three exceptions the interest shown by

the teachers proved to be temporary, and although, unlike other schools at this time, a large amount of software was available for them, it was generally of poor quality. The MEP Input pack (8) provided on the Induction course was of little use, as it mainly related to topics for older children.

A member of staff who retained an interest in the microcomputer, was the teacher in charge of the special unit. This teacher had never used a computer before but booked it for three periods the first week that it was available and used it constantly afterwards. Other teachers criticised the method that was employed in using it as all the programs used involved some form of game. But it was considered that with the attention span of these children being so short, a games element was essential.

The other member of staff who retained interest was one of the three who had attended the Induction course. This teacher taught Mathematics and used Dart (1) and Moves (5) to teach the pupils mathematical concepts. The Science teacher, who also had been on the Induction course, formed a computer club; very little software was available for teaching Science. This was common in all middle schools. Initially the amount of usage of the machine was discouraging, even though eventually other teachers attended in-service courses.

Usage:1984

After the school had had the microcomputer for one year, towards the end of 1984, three more teachers started to show an interest. The teacher for remedial children found some of the drill and practice programs beneficial, and another teacher was interested in using the software to accompany the television series, 'How We Used To Live'. Also, after attending a three day course, the teacher in

charge of the first year pupils became very interested in using the machine and eventually purchased another BBC, specifically for use in the first year school. The teacher in charge of the special unit also found that it was not viable to share a microcomputer with the other sections, and bought one especially for use in the unit. Disc units, one printer and the BBC buggy were purchased. The buggy was eventually relegated to a store cupboard.

The teachers were then requested to complete a questionnaire.

QUESTIONNAIRE:1984

Aim

The purpose was to establish who was using the microcomputer, how it was used, who intended to use it, and if they did not intend to, the reasons for not wishing to. Problems encountered and suggestions for improvements were also sought.

Results

Questionnaires issued 28

Questionnaires returned 28

Reasons for not having used the microcomputer.

Four teachers did not provide any answer to this question. Other responses:

"Lack of expertise"-(5), "Disadvantages far outweigh the advantages", "Programs are not applicable to my needs", "Lack of time", "No good reason FOR using", "Unconvinced that they have made a significant impact in the classroom", "Lack of suitable material".

Suggested improvements etc. before considering its use.

Considering the fact that seven teacher did not give an answer to this question suggests that they did not intend to use the microcomputer under any circumstance. Other responses:

"More experience required", "Staff familiarisation programme", "Implementation of staff training course", "Establishment of a

computer room", "More time allocated to computer use on the timetable", "Allow much more time with each group", "Provide facilities for use with larger groups", "More software", "Less complicated equipment", "Greater scope in the programs available", "More imaginative and challenging programs", "Materials that link with school's Social Studies schemes".

NOTE. Although this question was directed at non-users, the following suggestions from past users were also made:-

"Ease of transportation", "Large screen for classroom use", "Need to use the computer more than once a week", "Provision of a light pen", "Help with general information for Topic and General Knowledge", "Increased educational software needs to be readily available", "Circulation of information of software available", "Provision of printer".

How do you envisage future use in this School?

Nine teachers did not answer this question, hence either re-inforcing the previous statement that they did not intend using the microcomputer, or it may have been that they did not know how to use it. Other responses:

"Establish a computer room", "Small groups with wider range of software", "One in every class room being used by an independent group or individual tutor", "A useful addition to normal lessons", "Teaching programming", "More computers", "To be used more widely with more equipment and more good software needed", "Optimistically", "Used in all areas of the curriculum", "Demonstrations", "Putting across certain concepts to slow learners", "To compile pupil profiles over the whole year (at present 'hidden' on pupil's Reports)", "Used for Club activities and 'games' in the classroom", "As far as our imagination allows", "In certain circumstances as an additional approach".

Suggestions for use in specialist areas.

Twelve teachers had no suggestions to offer in answer to this question. Again this may have been due to apathy, or lack of knowledge. Other responses:

"Use with individual pupils on learning programs", "Explanations and reinforcement", "Children bringing their own computers and programs to School", "Probes and sensors in Science", "Information Store - Quest", "Language games for use in French club", "Establish pupil's profiles", "Individual or small groups use in lower English groups", "Combinations of sounds/pictures/colours", "Research and problem solving in Social Studies", "Permanent base for remedial children", "Setting aside a small area with all materials to hand", "Work with control systems".

Difficulties or problems encountered.

Eleven teachers did not answer this question, but, it could not be assumed that these teachers had not experienced any difficulties or problems. Other responses:

"Availability restricted" (5), "Lack of expertise"(2), "Transportation, connection and return" (4), "Lack of materials", "Software suitability a major problem", "Breakdown", "None serious", "Couldn't get it to work",

"Small size screen in large room".

Subjects/Topics covered using the microcomputer.

UNIT	Maths	- various topics.
	English	- various topics including spelling, sentences, vowels and alphabet.
	Logic games.	
1st YEAR	Maths	- various topics.
	English	- various topics.
	Geography Science Reading	
	Logic games	

MATHS TUTORS	Fractions, number patterns, long multiplication, long division, graphs, number bases, time, angles, tesselations, area, sets, number bonds, bearings, shapes, geometric drawing.
SCIENCE TUTORS	Periodic table of elements, sorting, meter reading, classification, balancing law, microbe reproduction rate, suite of programs "Using your Computer".
REMEDIAL DEPT.	Maths-sorting, counting, addition, subtraction, decomposition, shopping, money. English-spelling, sentence ordering, cloze procedure, reading, starting a story, alphabet, vowels, word recognition.

Further details: Questionnaire, Appendix D1.

Usage:1985

The school was visited and teachers were also contacted for telephone interviews. These included teachers who were not making use of the microcomputer besides those who were.

First Year Block

The microcomputer was being used extensively in this section. The member of staff in charge said the teachers in this section were almost fighting for the use of the one microcomputer, so they badly needed more, but couldn't see the way to getting them. Because she wanted to introduce wordprocessing she considered that the most pressing need was for a printer. These teachers were using the microcomputer across the curriculum and had collected a large amount of software and used most of it. They thought the drill and practice

programs had value for these pupils-in the nine plus age range. The MEP Primer Pack software (4) was much used. The teacher in charge was interested in getting the 'real' LOGO chip, having only used Dart (1). They had not used any simulations at that time, and had just started to use the microcomputer in Design. Besides using the microcomputer with small groups it was also used occasionally for class demonstration and for remedial work.

While the microcomputer was being used extensively in this section of the school, it was mainly used in a way which followed the traditional methods of teaching. The teacher in charge did not consider that it would make any difference to teaching and learning methods but that it simply complemented existing methods. She thought the microcomputer was an inducement for these children to work harder.

Transportation of equipment has not been any great problem for these teachers, the building being on one level and they had the equipment set up on a trolley. The exception had been when they wished to use a printer which they had to borrow from the main building.

Special Unit

The one microcomputer for the 14 children in this unit had proved to be sufficient. The microcomputer was still in constant use and the same kind of software combining a games element was in use. The teacher had tried Adventure programs but found they were of no use for these children as they had not the patience required to spend the time required to "get into them". He still found the microcomputer invaluable for them.

Main Building

In this main block about six of the teachers were using the microcomputer in the classroom, but only three or four constantly.

One of these was the teacher for remedial work and she was using it in the same way as the first year teachers. She had found these programs very beneficial for remedial children, but had also found the use of the microcomputer very beneficial for herself too. She considered that it was like having another teacher to help her. These classes were small with about twelve to fourteen children in each and organised into groups. While the children in a group used the microcomputer alone, they needed help to be at hand at times. This teacher was aware of using the same material repeatedly and felt there might be better software around if she had the time to look for it and view it. The time factor was stated to be a hindrance with a number of teachers. One social studies teacher was interested in using simulation and data base software, given the time to look at the software. A Mathematics teacher who had used Dart (1) and Moves (5) initially had not been using the microcomputer because of timetabling demands. These teachers are expected to cover specific topics with the children before they move on to the upper school.

The use of word processing had been found to be valuable with lower ability groups for writing stories and producing a class magazine. The problems experienced, besides that of mobility, was firstly due to having only one microcomputer, and the ensuing time it took for each group to enter their contributions, and secondly the extra harassment in class in having to attend to the machine besides disciplining the children. This teacher thought that other software was too 'gamefied'. He thought that software producers were of the opinion that children really did not wish to learn, but he considered that children do and that they appreciate formal lessons. He believed that learning involving a games content was more for the home. He had been disappointed with an Adventure game he had viewed.

While there was a problem of transporting and setting up equipment, in this main building, being located on more than one level, the children carried all the equipment around and set it up. Some teachers were concerned about children carrying expensive equipment in this way.

Findings:selected school

The teachers who were using the microcomputer in this school had been slow in their approach to using it in the classroom, but they considered they had been deliberately slow. It was expressed that conservatism was required in relation to the introduction of any innovation in education. Other reasons put forward for the slow acceptance was because the staff, in the main were mature, and also that rubbish was initially available. In most cases though the software had not been viewed in order to reach this conclusion. It was commonly supposed that it was rubbish, hence it was easier to accept this, particularly when staff were apprehensive of using the microcomputer. But the amount of time taken to view and get familiar with software, particularly the better software, and the additional time required to plan how to use it, had gradually been realised. Subject time tabling commitments also hindered usage. While one teacher considered using the microcomputer relieved the teacher in the classroom, another considered that it was an extra burden in addition to looking after the children.

The major users in this school had been from the special unit, the first year groups, remedial users and for mathematics. The advantage gained from carrying out the research in this selected school was in being able to discern another side of the picture to computers in education. While the microcomputer was gradually being introduced

into more topic areas, it was still much under-used, and many teachers still did not see the need to use it.

CHAPTER 3. DISCUSSION

This chapter commences with a perusal of selected secondary research that existed, or subsequently materialised, in the form of reports, surveys etc., and such that could be associated with the investigation. But, the research was expected to be mainly primary, being aware that, particularly at the commencement of the study, secondary sources of information on the topic were sparse. Initially there was little information available relating to the actual use of the microcomputer in the classroom, hence the reason for the placing of this review.

Following this literature review, the various relative efforts to meet societal needs are discussed. The next section summarises the differences found in the approaches to using the microcomputer that may be attributed to gender. The chapter ends with a discussion of the software and programming languages used in the educational establishments visited throughout the research period.

Secondary Sources.

Literature was selected that pertained to the manner in which the microcomputer was being, or could be, introduced into schools. The pedagogical approach was sought; particularly looking for any signs of the, frequently expressed, revolution in teaching and learning procedures, that would accompany the innovation. Details from past experiences in developing computer aided learning are also briefly reported.

Foundations: Computer Aided Instruction (CAI).

Early experimental projects in the use of the computer in education, (Suppes 1966) defined three levels of pupil- computer interaction. The drill and practice type system was introduced at

the most superficial level. The next level was the tutorial system; the main aim was, supposedly, to take over the main responsibility for instruction from the teacher. The pupils were to gain the benefit of individualised instruction. The third level attempted to bring about a dialogue between pupil and computer. This last level brought technological problems which have still not been overcome.

Looking Back.

In their paper on how microcomputers could be used to assist learning, Howe and duBouley (1979), 'turned back the clock' to assess the educational utility of programs which were implemented on larger computers. In doing so they forewarned that the experience gained, from this evaluation, should have prevented those programs, which were found to be educationally unsound, to be reimplemented on the microcomputers, and that their usage could be an educational regressive step. They considered that the claim of individualised instruction attributed to tutorial programs merely allowed the pupil individual access to the program. They polarised those teaching methods used in educational institutions, into those that brought about learning by being told at one extreme and learning through discovery at the other. Nevertheless, in their research into computer modelling, although they constructed a reactive learning situation, they found the learning activities had to be highly structured.

Future

The relationship between artificial intelligence (AI) and CAL was examined by Howe (1978). He found that explanatory teaching was not as widespread in the approaching 1980's as it had been in the 1960's. He stated that the divide that initially existed between the educational philosophy of CAI and the 'learning by doing' philosophy of AI was diminishing, and went on to explain that interest was

gradually moving towards the intelligent teaching programs in CAI. He was of the opinion that the deficiency of the traditional CAI program was to be found in it not understanding or knowing the topic being taught, hence it could not undertake the role of an intelligent teacher. In describing some programs which used AI techniques, he states that although these programs provided close guidance for the pupil, they did not provide the type of knowledge that the pupil required to overcome some ingrained misconception. Because of this, another approach to the use of computers in education transpired, that of building learning environments, e.g. the LOGO learning environment. The problem was then expanded relating to whether the LOGO environment would help the pupil's learning in the classroom, considering that Papert (1980) argued that the innovation should not take place in existing classroom environments, and that the curriculum needed altering in order to obtain maximum benefit.

In contemplating the micro revolution, Howe (1982) looked for reasons why technological aids were failing to make much impact on classroom practice. He specified the availability and reliability of equipment, and the relationship of its complexity to staff efficiency. Whereas in the primary school the difficulties encountered would most likely be technical he considered the classroom practice prevailing in secondary schools to be a hindrance. He stated that technological innovation depended on a problem-solving methodology and that the microelectronic technology could be used to bring about a 'top-down problem-solving methodology'. But to do this the syllabus would have to be cut down in order to provide increased time for experimentation and exploration. Teachers have in fact found that plain, discovery learning was difficult to accomplish in a forty-five minute,

subject-bound lesson.

Learner Control

Holmes, Robson and Steward (1985) found that the benefits to be gained from learner control were not evident in their investigation. They used a teaching program that offered students control over content, style and level of difficulty, i.e. the learner was offered a choice over the instruction they received. With content control they realised that often the lower secondary school children taking part in the investigation were unable to make informed choices because they did not sufficiently understand which particular units to select. While the investigation did not reveal any clear improvements in learning from learner control over computer control, it was considered that the time period was too short for the pupils to adjust to the task of making their own decisions about the instruction. Again this endorses the requirement for guidance. Preliminary results from research carried out in the USA indicated that learner control was a learned skill. (Merrill 1979).

Intelligent Tutoring Systems (ITS).

Sleeman (1985) considered that ITS would have some impact on the classroom. He continued by stating that the advocates of LOGO consider that any form of tutorial approach was wrong and that discovery methods were required. He argued that there was evidence, from traditional classroom teaching, that some pupils required support; the amount required depending on their ability in the particular subjects. He also advocated an approach which was somewhere between the tutorial and the discovery system. Systems which provide a problem solving environment fit into this central area. In this environment the pupil can ask for support as needed. Self (1985) suggests that the emphasis for implementing these ITS should be based on a guided discovery learning style, developed

around machine learning programs; rather than the pupil being taught by following some predetermined standard, based on the idea of an expert system. He envisages such tutoring systems materialising by basing their development on machine learning research but with the machine learning taking place in parallel with the student's learning.

While CAL was being used to bring about the building of learning environments, it was also gradually moving towards the use of intelligent teaching programs. But, the need for a restructured curriculum to enable the transition was thought necessary.

Official Programmes.

The National Development Programme in Computer Assisted Learning, (NDPCAL) began in 1973 and continued until 1977. An independent education evaluation of the NDPCAL was undertaken by the UNderstanding Computer Assisted Learning (UNCAL) team,(Kemmis,Atkin & Wright 1977). They specified three curriculum paradigms within which CAL could be justified in educational terms: instructional, revelatory and conjectural. In relation to the NDPCAL projects, they found that the instructional could be associated with the adaptive-tutorial projects: the revelatory to simulation and data handling projects: conjectural to the model building projects. A possible fourth was suggested as emancipatory, which could be associated with the calculating, tabulating and graph plotting projects.

Those projects and studies which referred to schools, (CET 1977) related to Mathematics, Remedial Reading, Timetabling, History, Local Informatiom and Geography. A mathematics system developed not only marked, assessed and routed pupils, but generated an arithmetic

test sheet geared to the individual needs of the pupil. The computer aspect of one system for the teaching of remedial reading was not successful and was suspended. The remaining topics, excluding timetabling, proved important in illustrating the benefits of developing and interrogating a database in the classroom.

The Microcomputers in Education Programme (MEP) was announced in 1980 to run for four years at a cost of 9m. Ultimately the Programme's length was extended until March 1986 and its finances increased. When the Programme's aims had eventually been finalised, its priorities were stated as providing information, in-service education and curriculum development. Self (1985) writes that MEP made the least progress in the third area, curriculum development. MEP maintained that in teaching WITH computers it would teach children ABOUT computers. Subsequently the DoI launched its equipment subsidy scheme. This meant that MEP then had to provide starter programming packs for the ensuing compulsory training courses for teachers. Hence the Programme's concentration on producing quantity rather than quality. Self considered that the CAL software thus produced was so different from the majority of computer software that it gave children 'a distorted view of the strengths and limitations of computers'. A major weakness in the MEP activities was the lack of evaluation procedures.

In 1982 MEP established four Special Education Microelectronic Resource Centres, (SEMERC). Primary school teacher's criticism of MEP was that they considered that it was principally concerned with secondary education. This was probably due to the primary schools initially not being included in the DoI's equipment offer. Further criticism was aimed at the initial lack of information emminating from MEP relating to what the Programme was trying to achieve.

The government's new scheme, The Micro Electronics Support Unit, may initially help schools to purchase more software for existing microcomputers in schools, but may not stimulate new developments of 16-bit applications for education.

Special Education

A three year programme, funded by the Schools Council, commenced in 1980. Its main concern was the individualisation of teaching and learning. The publication 'Microcomputers in Special Education' (Green et al. 1982) describes the part of the programme that relates to the curricula requirements of pupils who have special educational needs. Brief guidelines are provided in order that teachers can experiment with the new technology. Children of low ability form the greatest number with special need, and the microcomputer is used to help in their aquisition of basic skills. The paper states that these skills should be applied to real situations, and a keyboard consisting of real coins is given as an example. The need for teachers to use imagination in linking microcomputers to an educational situation is put forward. The authors then list the accepted characteristics of special need and specify how the microcomputer can contribute to compensate for these characteristics, e.g. how the software can create a high level of interest to compensate for the short attention span. With other handicapped groups, an understanding by those working with these children of the educational principles involved is stressed, rather than an over-emphasis on the role the computer can play. The opinion expressed in this paper is that many teachers in special education consider the use of teaching machines, of any kind, incompatible with a personalised approach to education. Research carried out with teachers of special education did not verify this. Observations showed that use of the microcomputers created a more

personalised environment between teachers and children.

Research Programme

The former Social Science Research Council (SSRC) Working Group on Microcomputers in Schools proposed a research programme on 'The Use and Application of Microelectronics in Education' in 1981. The Council approved a programme of work and subsequently the report 'Microcomputers in Education: A Framework for Research' (Sage&Smith 1983) was published as a discussion paper. It reviewed research and development activity in information technology in education. This report showed that development had taken place without substantial research and specified a situation described as 'theoretical impoverishment'. This was probably due to the accepted premise that teachers are dismissive of theoretical considerations to classroom practice. But in this case teachers were not allowed the time for any research to be carried out first, they had no choice but simply to get on with the job of using the microcomputer in the classroom according to their own jurisdiction.

The document stated that courseware was required that reacted "intelligently" to the needs of individuals in the learning situation, and that the educational materials that had been developed mainly simulated traditional methods and practices in the classroom. While this situation exists, software that behaves "intelligently" will not only require professional computer programmers to produce it, but will also require more up to date hardware than that found in most schools. The need for measuring the effects of children growing up in a computer-rich environment was called for. Even though the latter must be a long term project, little was on-going in that direction. The report also looked at how the Alvey Report (a report from a DoTI committee which recommended the setting-up of a national programme for advanced information

technology) was critical of the benefit to schools of adding small unplanned measures of new subjects to their curriculum with the aim of bestowing the nebulously defined computer literacy to all children. The authors maintain that future developments must be built on a foundation of theory to prevent the wastage of decades spent searching blindly for the key to the effective use of computer based technology in education.

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'Microcomputers and Mathematics in Schools' is a discussion paper published in 1983. It resulted from visits to schools and information gathered by a number of H M Inspectors. This followed the Cockcroft Report, 'Mathematics Counts (HMSO1982), which contained a chapter on calculators and microcomputers. The extent that these machines should change the content of what is taught about mathematics, or the relative stress placed on parts of the content was dealt with. The HMI report is rather out of date with what is currently seen in schools, being submitted in 1981. But what it does state is that the learning of mathematics requires a certain amount of drill and practice, and this is more boring and anxiety-producing without the use of computers. The point made that is still relevant, was that if practice is to be of value, needs have to be diagnosed and related to the child's level of development, and that no software had been seen that assists this role to any extent. The virtues associated with the use of LOGO in mathematics are also extolled in this document. This is dealt with in the software section.

Interactive Videodiscs

The potential of interactive video for education has so far only been realised by a few teachers. The National Interactive Video Centre in London, run by CET should help rectify this situation. Its

role is to give support, information, advice, demonstration, and training for anyone interested in using interactive video as a teaching aid. But even with this help, the prohibiting factor to its use in schools will be the cost of this resource. While video tape can be used interactively, it is slow and does not create the sharply defined and steady images as the video discs do. An independent evaluation of the use of the videodisc player in four primary schools is described in the report 'Interactive Videodiscs in Primary Schools' (Mably 1984). This was the first time this medium had been used in primary schools. It was used for class teaching, group work, individual pupils, and staff development. The fast random access was found to be of value by the teachers, but some wanted to interface the system to a microcomputer. Despite the title of the report, the system was actually only an active system and required to be computer controlled in order to make it truly interactive.

The BBC's Domesday Project marks the 900th anniversary of the "Domesday Book" A videodisc package consisting of three videodiscs, one made up from contributions from 9 to 14 year-old children, records life in Britain in the 80's. Unfortunately, schools that have collected the data will not be able to afford to buy the player and discs to access this database, or in fact even purchase the second processor required. This demonstrates the unsuitability of the equipment at present found in schools for any future developments.

Welsh Schools Survey.1983

This Report by HM Inspectors (Welsh Office 1983) was included in order to compare the way the microcomputer was being implemented in Welsh schools, with those schools included in this research.

The object of the above survey, carried out in the Summer Term

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role is to give support, information, advice, demonstration, and training for anyone interested in using interactive video as a teaching aid. But even with this help, the prohibiting factor to its use in schools will be the cost of this resource. While video tape can be used interactively, it is slow and does not create the sharply defined and steady images as the video discs do. An independent evaluation of the use of the videodisc player in four primary schools is described in the report 'Interactive Videodiscs in Primary Schools' (Mably 1984). This was the first time this medium had been used in primary schools. It was used for class teaching, group work, individual pupils, and staff development. The fast random access was found to be of value by the teachers, but some wanted to interface the system to a microcomputer. Despite the title of the report, the system was actually only an active system and required to be computer controlled in order to make it truly interactive.

The BBC's Domesday Project marks the 900th anniversary of the "Domesday Book" A videodisc package consisting of three videodiscs, one made up from contributions from 9 to 14 year-old children, records life in Britain in the 80's. Unfortunately, schools that have collected the data will not be able to afford to buy the player and discs to access this database, or in fact even purchase the second processor required. This demonstrates the unsuitability of the equipment at present found in schools for any future developments.

Welsh Schools Survey.1983

This Report by HM Inspectors (Welsh Office 1983) was included in order to compare the way the microcomputer was being implemented in Welsh schools, with those schools included in this research.

The object of the above survey, carried out in the Summer Term

1983, was to 'assess the impact and possible implications of the new technology within schools'. Thirty-five schools were visited; these schools were located over a wide area of Wales, and catered for children of eleven years upwards. Most of the schools selected were known to have an interest in the educational use of microcomputers.

Equipment

The majority of Welsh authorities had opted for the use of the BBC microcomputer in their schools. Most schools housed them in a special computer room. There was a liaison between some schools and colleges so that the pupils could use the more sophisticated college equipment, and the lecturers from the colleges visit the schools. The report expressed concern at the variation in the level of provision of equipment that was found in different schools.

Teaching Staff

The inspectors found that there was a cautious approach in using the microcomputer amongst the teachers. Each department was allowed to follow their own interests. One LEA was allowing the teachers release from school, part-time, for developing educational software and was providing specialist help for the teachers in their task. Technician support was available in some schools but this was not very adequate. Most schools had a teacher, usually from the mathematics department, responsible for computer studies.

Method of Usage

The microcomputer was found to be used as an electronic blackboard and the only asset claimed from this was that it produced a 'neat screen display', and followed the traditional teacher-directed approach, with the class as rather passive passengers. Other examples observed did include individual, group, and class use with the whole class participating. The microcomputer was thought to be better organised for use in remedial work and its potential was very

much recognised in the special schools, where it was used with individual pupils. Micro-based braille terminals, voice synthesisers, braille print-outs and large screen displays, the latter for the partially sighted pupil, were in use in the special schools. Much use was made of word processing packages. The microcomputer was being used for administration purposes in a number of schools.

Siting Equipment

Although special computer rooms were used, it was observed that much time was wasted carrying equipment around to the various classrooms and then arranging pupils in positions to enable them to be able to view the screen.

Software

A shortage of good educational software was reported, also that teachers needed support in evaluating software and were cautious about purchasing it. Some schools were starting to use word processing packages. What was termed a 'mid-school gap' was noticed with software. This was the gap between software for sixth-formers and the kind used to improve basic skills of language and literacy. The better type of software in use was found to be that used for creating databases which allowed pupils to form and test hypotheses and take various courses of action in solving problems.

Courses

There was much demand for examinable courses for pupils, both by parents and pupils. But, because this entailed only a minority of pupils, schools were trying to introduce courses which could be offered to all pupils.

Gender Differences

It was reported that the boys accounted for two-thirds of the applicants for examinations in computer subjects, and that there was

a male bias in the computer club attendances.

Concluding Observation

Typically, there were six computers per school and these were not available to all the school population. Only about one tenth of teachers had attended in-service courses in the subject.

Comparison

Very little difference was to be found in the pattern followed in the Welsh schools, at that time, from that followed in the schools being researched for this thesis. The liaison mentioned between schools and colleges in certain areas of Wales, would be beneficial for all areas; this existed in the past in the Chiltern area, before schools purchased microcomputers. These Welsh schools were also beginning to benefit from the introduction of technician aid, albeit only to a small degree at that time.

While case studies and anecdotal information, relating to the use of the microcomputer in the classroom, were gradually appearing in the various periogicals, the problem lay in obtaining literature which was typical of the general situation.

Societal Needs

Much effort is being aimed at the furthering of life skills, starting in the lower schools. In the upper schools, the aim is to further these skills, but also to prepare pupils for eventual work in industry. In order to determine if schools were catering for the needs of society, literature on pre-vocational education was inspected.

Pre-vocational Education A consultative paper:'Providing Educational Opportunities for the 16-18 year olds', (DES 1979) put various suggestions forward, compiled with the aim of making a success of education for the 16-18 year olds. One question raised was whether some vocational courses, which were usually provided in further education colleges, should be provided in schools or sixth form colleges instead. Since then, the number of courses in pre-vocational education has proliferated. These are outlined as follows:

1.In order to meet the computer skills shortage, training programmes have been financed by the Manpower Services Commission (MSC). Initially these programmes started in the further education colleges by way of the Training Opportunities Scheme,(TOPS) and the National Computer Centre (NCC) Threshold Scheme.

2.Under the Youth Training Scheme (YTS), a wide range of courses are available for 16 year olds, and each must contain some coverage of Information Technology.

3. For the under 18 year olds, Information Technology Centres (ITECS) have also been set up.

4.Training in computer skills for the 14 year old plus pupil is available under the Technical and Vocational Education Initiative (TVEI). This scheme, launched in 1982 and started in 1983 with the

aim of stimulating the provision of technical and vocational education for young people, had no specific core of skills, aims and objectives; this was in order that LEA's could develop their own curricula relating specifically to the particular area. Work experience from the age of 15 is planned. The pupils may take the TEC/BEC General, the City and Guilds Certificate, the Royal Society of Arts examinations and CPVE, specified below.

5.The Certificate of Pre-vocational Education (CPVE), launched in January 1985, provides training for those who have completed their statutory schooling.

RESULTS

1.Initially employers did not have much confidence in the TOPS scheme, in particular the computer programming course, but this has now improved and MSC figures show that about 70% of these graduates find work on completing their training; many return to firms where they worked during their training.

2.The NCC Threshold course has built up a good reputation over the years. According to NCC figures, 30% of trainees are employed by the firms where they worked during their training. This can be endorsed by even higher figures from the author's college. Firms repeatedly put forward requests to colleges for these students to work for them while they are on this course, and 80% of the students find jobs either during, or on completion of their training, or shortly afterwards.

3.YTS courses, which are work based, have received much criticism, often being viewed as a form of cheap labour. Also there has been indications that the teaching of Life Skills has been sacrificed for an over narrow occupational training.

4.The main criticism about the ITECS is that there are too few in existence and many young people would like to have the opportunity

to receive this training. It has been stated that girls are mainly trained in word processing for future office work.

5.One criticism of TVEI was that it reinforced sex stereotyping because girls were opting for traditionally female subject options. This tendency for girls to go for business studies options and the boys for technology-oriented options is now being tackled by some authorities. The problem of sex stereotyping has concerned the Bedfordshire Educational Authority for a number of years. With the approval of the TVEI Unit, they commissioned a research survey with the Open University. Interviews were conducted with about 50 pupils in the five TVEI schools in the county. They were asked why they made option choices, and in particular, what pressures were brought to bear on them. It was found that the pupils had chosen subjects that crossed traditional sex stereotyped boundaries. But overall this TVEI scheme, designed to encourage experiments on job-related education, still engenders much criticism about the possibility of changing the aims of the educational system.

6.The CPVE course should go some way to ensure entry for students to vocational courses in further education such as the BTEC National. A part-time CPVE planned for 1986, means that YTS students could take the certificate, except that the present 13 weeks off-the-job training for YTS courses would be inadequate for the CPVE.

Conclusions on the above topic are included in the findings of this thesis. Further details on sex streotyping are included in the next section.

GENDER DIFFERENCES

Research into the area of the attitude of boys and girls to using the microcomputer in schools shows that initially when the children start school at four or five years old, the girls are the more 'pushy' when using the microcomputer. They are very impatient and bossy with the boys who are slower in responding to the requests made of them by the software. The girls are also, initially, both quicker and more correct in the answers they give. It is at this stage that it would be enlightening to discover why there should eventually be a change in attitudes. It is clearly not a natural process that makes girls reticent about using the computer, i.e. due to sex differences which are biological and immutable, Oakley(1972). It is due to gender differences which are socially constructed. Cultural influences are to be found in the home, in the school and in society, but many concepts of sex roles are firmly fixed in the early years. In the home the presents given to children relate to their sex. In the formative years then, before gender differences become more obvious and permanent, a changed attitude to expectation of sex roles in the home could be beneficial. The media could bring about much of this change, but at present it simply re-inforces the old attitudes.

The Cockcroft Committee, (Cockcroft 1982) disclosed that a similar practice occurs in nursery classes. Boys were given toys which furthered spatial awareness and problem solving. While carrying out this research, a lower school was visited in order to observe children using BIGTRAK, a programmable toy tank. The teacher expressed surprise when a request was made, after she had allocated a group consisting of boys only for observation, that girls should form part of the group.

The report "Sex Stereotyping and the Early Years of Schooling" (May&Ruddick 1983) illustrates the benefit to be gained from teachers determining for themselves the extent to which they perpetuate stereotyping. The major problem lies in endeavouring to make teachers realise that they themselves are often very much responsible for the continuation of traditional sex roles. In the publication:"GIST or PIST:Girls Into Science and Technology" (Payne et.al.1984) the researchers concluded that the project had at least sharpened the teacher's awareness of the problem of sex stereotyping.

But the situation is, that boys do take over, from about the age of seven or eight years, to become the dominant users of the microcomputer from then onwards. In the upper schools, only 26.9% of girls passed G.C.E.'O' level , and 19.6% 'A' level in computer subjects in England in 1983: DES figures. Research for this thesis, carried out in independent schools, showed that a greater number of girls than boys were studying for these examinations. But the girls who do take these courses are only interested in using the computer to develop and complete project work and their teachers report that these girls do not like programming. They are not keen members of computer clubs and do not like playing games on the computer.

New topics entailing the use of word processing and information retrieval software have been introduced in the middle schools and beyond. These topics are attracting girls to using microcomputers, but these are traditional role-related topics and they will possibly do little to diminish the stereotyped female roles.

The terms of the TVEI projects (1984) specified criteria to aid the sex streotyping problem. In order that particular establishments remain funded, an effort has been made to fulfil the terms. Some examples of the criteria are: 'the programmes should offer equal opportunities to boys and girls', and 'care should be taken to avoid

sex stereotyping'. It is advised that strategies should be employed to achieve balance and breadth in project areas, in order to counteract girls tending to opt for the 'business' and 'service' areas and boys for technology. Hence business studies have an information technology component. Despite this, much criticism from teachers has been levelled against the scheme, claiming that while the letter of the agreement is fulfilled by offering all courses to boys and girls, timetabling options channel pupils into traditional occupational skills, and that the scheme has done more to reinforce occupational streotyping than to reduce it. It is possible that girls need more councilling about choosing options. Some authorities are now aware of the problems and are adjusting their schemes. Pupils attending TVEI schools were interviewed for the survey commissioned by Bedfordshire Educational Authority with the Open University. The pupils chosen were those who had made non-traditional option choices. The girls had selected options such as technology, physics, computing, and technical graphics. The boys had selected business studies, including typing, and home economics. It was found that parents and subject teachers had provided most influence on option choices and few pupils had received career advice. A number of girls stated that school posters showing girls in science and technology had prompted them in their choice. The survey was carried out in the autumn term of 1984. But, while teachers are attempting to ensure that girls are opting for some form of technology, it can hardly eradicate the underlying cause. Campaigns such as Women Into Science and Engineering, (WISE1984) to bring more women engineers into British Industry, are based on the realisation that not only do girls need to engage in these non-traditional roles in order to be able to function in tomorrow's society, but that the country is losing out on half its potential strength if they do not.

EDUCATIONAL SOFTWARE

The quality of the software may be considered to be a major determinant in deciding whether the microcomputer integrates successfully into the schools. By the summer term of 1985 teachers were beginning to be overwhelmed by the increasing amount of, so called, educational software that had mushroomed over the last months.

This courseware can be categorised as follows:

(i) content free software such as programming languages, word processing and information handling systems

(ii) simulations

(iii) games

(iv) rote learning programs.

Development

The microcomputer was mainly introduced into the classrooms of the lower and middle schools by the use of simple drill and practice programs, initially written by the teachers. Some teachers also taught the children BASIC programming concepts. The use of the rote learning type of program was perhaps inevitable. Besides being the easiest to write, it simply continued along the same path that the earlier computer aided learning programs had taken, based on the teaching machines of the sixties, and reinforcing Skinnerian principles. While the continued use of the microcomputer in this way has not been encouraged, initially it did introduce teachers to using a machine in the classroom in a way that involved the kind of teaching and learning that was familiar to them. The possibility was that teachers would have rejected the microcomputer if they had been introduced to it in a revolutionary manner, but the majority of these programs were of poor quality. The next progression in the

type of software used in these schools was simulations; these had formed a major part of the National Development Programme in Computer Assisted Learning projects (Hooper&Toye,1975). LOGO type software was also much favoured.

During 1984 schools were having their microcomputers delivered after a long waiting period, but accompanied by an acute shortage of software. What was available was mainly extremely bad, both technically and educationally, but the teachers were soon to recognise the latter and refrain from using it. Initially the special schools had also found that the software available was unsuitable and not geared to the needs of their pupils, but the formation of the Special Education MicroElectronic Resource Centres, the SEMERCs, provided a good source for obtaining specialised software. The upper schools had used computers for a number of years, but mainly to teach pupils sufficient programming so that they could complete a programming project as part of the requirements for computer studies examination courses. With the increase of microcomputers in these schools, the amount of software had also increased. The 'mid-school gap' had developed which meant that there was a vacuum between the software available for sixth formers and that used for enhancing basic skills. The trend in 1985 was for the development of computer appreciation classes for all pupils, using commercially oriented packages and curriculum specific packages. In middle schools the potential of Adventure games was also being explored. The privately maintained schools had also mainly used microcomputers for programming courses, but with the establishment of an Independent Schools Microelectronic Centre, ISMEC maintaining contact with MEP, the majority of these schools were using much the same software as the maintained schools. The BBC Domesday Project initiated much interest in schools in file

handling.

Throughout the development period of the use of microcomputers in schools, past failings in computer aided learning were ignored. The advent of the use of the microcomputer in the classroom was followed by an influx of indifferent, rote learning type programs. Also the lessons learned by the Data Processing practitioner in order to produce good, reliable software were ignored. Producers of educational software have made the same mistakes. While educational software often remains technically unsound, educationally it is improving, and gradually the type of software that does arouse the pupil's curiosity to develop problem solving and decision making skills is emerging.

Organisation

The main drive for producing educational software was through the MEP funding software development projects; the distribution of software being in the hands of commercial book publishers. Copyright infringement usually infers that no software is available on approval. The network of regional information centres across the country provided a means whereby teachers could inspect software. Special education was catered for by the SEMERCs with a representative in every LEA, where free software was available. ISMEC provided software for the independent schools. MEP spent about five million pounds on educational software development from 1981 to 1985. But, in 1983 the total market for educational software was about one million pounds, this compares unfavourably with the educational book market for that year of seventy million pounds.

Problems

A school purchases many copies of a book but only one software package. This is not an inducement to publishers of software. The problem of copyright infringement is raised when software is

provided on approval, but teachers have categorically stated that they need to view before purchasing. Publishers have found that software that is not protected sells better when the teachers are able to modify it to suit their own requirements, but this induces copyright infringement. Because of the time taken for commercial publishers to package and market materials, software cottage industries were set up and the software produced in this way was often very inferior.

The need for curriculum specific packages is evident, but generally only upper schools can afford the cost of such packages for one subject. Schools that purchased network systems found that their existing software was not compatible with the network system. In general, technological improvements, additions, and enhancements require existing software to be updated. The gradual uptake of 16 bit processors by the schools will create further problems of incompatability with the existing software.

Evaluation

Because there was no coherent policy for Computer Education in schools, no specific objectives were set out as a standard against which the success of teaching and learning could be measured. Hence, evaluation of educational software was not an intrinsic part of the MEP project, but this was also due to the dire need for software with the result that the main concern was for quantity rather than quality.

Educational Value

Teachers are proving themselves to be capable of carrying out practical evaluation of software in a classroom setting by observing what happens and deciding where the value of certain software lies, often depending on the individual child's needs. But professional judgement cannot stand alone, and objectives are required for

rigorous evaluation, although at the same time agreeing with the statement that all that is not measurable is of no value (HOLT 1981). The use of microcomputers in some special schools easily verifies this statement. To attempt to measure the effect that using a microcomputer has on a handicapped child's lifestyle would be an impossible task. Holt considers that too much emphasis on the drab routines employed in evaluation will detract from the importance of the creative pleasures of planning, teaching and learning.

Drill and Practice

Much of the software that has been produced follows the programmed instruction model, also following the DoI's definition of computer aided learning as 'interactive systems in which the computer "teaches" the pupil by question and answer' (DoI1981). While this type of software does not fulfil the role of CAL or lead to inculcating problem solving skills, the rote learning involved has been attributed certain assets. Professor Halliday, psychologist from Manchester University, considers rote learning can be valuable. For example, he considers that rote learning of multiplication tables eases the burden imposed on children's embryonic memories. Young children do not have command of the tricks used by adults to memorise information. Adults use these tricks to recall lists of numbers, but children are better at recalling pictures, which are a truer test of memory, where tricks can not be made use of. If rote learning is of value in this way, then the microcomputer can enhance the learning by providing pictorial representations.

Rote learning programs have received so much criticism that teachers often admit to using them apologetically; but they use them because, providing they are open ended, they have a value for particular pupils who are slow in understanding some concepts and who require individual attention. The teacher often cannot provide

this with large classes.

A further endorsement of the use of this type of software is contained in the discussion in Microcomputers and Mathematics in Schools, Fletcher (1983). This states that, "The learning of mathematics requires a certain amount of carefully planned drill and practice....major difficulties associated with excessive drill and practice are boredom and the feeling of inadequacy, anxiety..." the discussion goes on to state that the anxiety is mainly absent with computer managed drill and practice, but that it has to be related to the pupil's stage of development. This type of software also requires the least teacher preparation time, but it has often been observed to be mis-used. While carrying out research for this thesis, complete classes of children have been observed slavishly working through computerised table tests, whether or not they needed the reinforcement.

Simulations

Simulations which involve direct interaction and decision making enhance active, rather than passive learning. But they can demand much teacher and class time and are often only viable in the lower school when the project is planned to cover a number of curriculum areas. Evaluating the results often involves complex record keeping to determine what the children are doing and learning. Self (1985) states that almost nothing is known about just what children do learn from the use of computerised simulations, although O'Shea&Self (1983) consider their advantages as an approach to learning are well appreciated outside computer-assisted learning.

The main conclusion of the report Microcomputers in Primary Education (1983), was that the success of the microcomputer in these schools depended very much on the time and effort that the teacher spent on integrating it. The most successful uses observed for this

current research were clearly those where it was evident that the teacher had devoted much time in planning the use of simulations; for example, the use of the Mary Rose software across the curriculum, in a lower school visited.

Simulations used in the upper schools are often subject specific, and also used in computer studies with the aim of showing the pupils real life applications. In earlier research with undergraduate students, Laurillard (1978) claimed that they proved to be educationally valuable.

Games

The educational effectiveness of computerised games has not been identified. While the arcade type have proved extremely popular, the loss in popularity of the home computer may reveal a diminishing interest in these games. Novelty is usually short lived. But children do enjoy the fun element contained in games. While this cannot be sufficient reason for the use of this type of software in the classroom, a games element included can often be beneficial when used in an educational context. At present children are still motivated when using the microcomputer, hence fulfilling the objectives of Gronlund's affective domain (Gronlund 1970). Claims have been made that their motivation is increased when games are used. Rowntree (1982) writes that pupils are motivated when they identify with the objectives to which the learning leads. Following on from this, Self (1985) considers that computer games are not neccessarily motivating since the player's objectives in playing are not often the same as the intended learning objectives. Malone (1980) carried out a study to find what made computer games fun, and named three categories:- challenge, fantasy and curiosity, as the characteristics required. This was compared by O'Shea & Self (1983), with Piaget's theory that a human had the will for mastery

(challenge), to search for the best informative environments (curiosity), and to use schemes from other contexts (fantasy). Malone interviewed pupils about their computer games preferences. When asking about the features of a popular game that were missing in an unpopular one, he found that the sexes differed in their choice of best features. Hence he decided that fantasies used should be chosen carefully so that they relate to the user. But if the ideas that girls were thought to favour, were included in educational software, in order to tempt more of them to use the microcomputer, they would relate to traditional female fantasies. This is analogous to the procedure already employed to attract girls into using the microcomputer by the use of word processing and file handling packages, employing traditional female type topics. This study provided an indication for the reason for girl's dislike of computer games. Most writers of games software are male, hence they will include male fantasies.

Adventure games.

Many teachers are convinced of the value of adventure games. While it may be doubtful that the problem solving carried out in these games is not akin to the problems that the child will meet in the real life situation, the development of problem solving techniques is claimed by the use of them. Other advantages are evident. The imagination required and the accompanying planning and discussion involved have no replicate with other teaching methods; albeit teaching skills are necessary to make the best use of these programs. Even the most reticent child has been known to join in these discussions. It is an open ended situation, not like a story. The computer's reaction is dependent on the choice of action that the children decide.

Content-free Software

Examples: languages, file handling software, information retrieval, wordprocessing. Languages are discussed in the programming language section.

Wordprocessing

The ensuing discussion that is usually observed among a group of children when using a wordprocessing package shows how written language can be formed from spoken language. Previously, creative writing in the classroom did not include talk. Some teachers have the same ideas about the use of wordprocessing that they had about the use of calculators in the classroom, stating the former to be the lazy way to write. It has also been feared that the skill of handwriting would suffer. But the confidence its use creates in children who previously could never produce a well written, neatly presented piece of work, has been realised by most teachers. The lack of typing skills has been thought to be a hindrance. With text so easily changed, compared to altering mistakes when using a typewriter, the need for these skills is hardly important.

File-handling, information retrieval

The ability to handle data and interpret the data retrieved is of importance for children. All grades of schools have found value in the use of database type software, even though a manual system could be used. In using computer software, besides language development, children learn how to store, classify, and retrieve facts quickly. This often involves the children in real life problem solving of their own design, but they also make a contribution to their own learning. Unfortunately none of the type of database software available for school use caters for the storage of relationships. Hence when creating files, the pupil is prohibited from defining the relationships of the variables within the subject area. Some packages do not use a query language, but depend on menu driven

interaction. This is considered to relieve the child from having to recall the commands of such a language. But children observed using a menu driven package i.e.Factfile (9), had difficulty in understanding the meaning of words used such as 'entry','item', and 'headings'. Micro-Prolog could be used oftener in schools for the writing and interrogation of databases.

The BBC's Domesday Project involved pupils in an interesting exercise gathering information for a national database. The major complaint, gleaned from teachers in schools taking part in the project, was the time constraint; only a few weeks were allowed to gather the data and the fear was that the result may be inaccurate information. Another constraint, put forward by these teachers, was the amount of disc storage allocated to each school; this made for a difficult decision relating to what to include. They considered that the project was valuable from the point of view of introducing links between the school and the community, but that was not the object of the exercise. While this data was for an interactive videodisc, as yet there are none available for school use. When they are available the schools will not be able to afford them.

Viewdata

While much use could be made of the Prestel Education Service by schools, initially the majority could not afford the cost of equipment, telephone charges, and connect time. In a large number of schools peak telephone charge rates would be in operation. The Times Network offers LEA's their own small databases which they can use to communicate with their own schools. The Chiltern region promoted INFOVIEW for schools to access Prestel and build up their own databases.

Learner controlled software

The use of authoring languages enables the creation of learning

programmes whereby the learner is allowed varying degrees of control over the learning process rather than the computer being in control. An investigation carried out by Holmes et al.(1985) did not reveal any discernable learning improvements in the use of a learner control program over a computer controlled one.

Summary

Initially it was a novelty to see a machine generate table questions randomly, but as teachers became more sophisticated users, they became more discriminatory and did not use software simply because it was there. But training is required in order to be able to evaluate all the attributes of good software. Over the years teachers have become proficient at evaluating good text books, but to evaluate software thoroughly also requires technical appreciation.

Technical Evaluation

Because simple rote learning programs were found to be easy to write, the expertise required to develop high quality software has not been realised. The analysis, design and rigorous testing procedures required for any data processing project to be successful has been omitted. These procedures are even more essential for the classroom, which is much more needful than a commercial establishment, hence is more entitled to systematic planning of software. Bell(1980) writes of the difficulties of producing computer aided learning software on a small minicomputer, but it is even more difficult to design software to fit the confines of a small microcomputer. Problems that have arisen relating to the portability of knowledge based systems have revealed the lack of any systems methodology. The realisation of the value of commercially produced software in schools is borne out by the fact that the software most in use is that produced by commercial enterprises,

such as database systems, wordprocessing packages and programming languages.

Userfriendliness

Reliability of software in the classroom is an important aspect, but this cannot be accomplished when rigorous testing has not taken place. No matter what level of testing has taken place though, systems do fail and any user surely deserves some explanation rather than being left with the conviction of their own failure. User friendly systems are particularly required in schools where the user is a non-computer specialist. Even if the software was effective, it may still be unhelpful. This can be extremely confusing for the new users, leading to a distrust of their own ability and possibly distrust of the computer too, and may deter them from attempting to make use of its facilities again. Surprisingly, teachers have been observed using inferior software which has failed and have repeatedly tried all kinds of recovery methods themselves, treating the breakdown as a challenge. One major failing is the omission of facilities to exit and re-start as required. This enhances the user's feelings of being in control. Teachers have often been burdened with software that they could not terminate when they were experiencing difficulty with, or re-start without having to re-load the program; this often entailed unsuccessful attempts at loading, and from slow tape cassette players too. Software should provide feed-back in relation to incorrect responses or acknowledgement of correct responses to increase user confidence. Often the user is left wondering what is required next. Such user aids are not only costly in development time, but often prove impossible to include using the low powered BBC microcomputer. Also it is often impossible to take advantage of the BBC microcomputer's good graphic facilities because of lack of space. A good presentation is not just required

from a technical point of view, but also educationally. Often though, a bad presentation is not due to the lack of storage, but to insufficient care in layout, with words split at the end of lines.

The ultimate software would be intelligent knowledge based systems, but once again, with the low powered machines in use, this would prove impossible.

Future Policy

The MEP's successor is the Microelectronics Support Unit, which will give financial help to LEA's for the purchase of software for schools. But no advice will be forthcoming relating to the purchase of it. United States delegates at a UK/USA microelectronics seminar held in May 1985, were most surprised that there was no advice from national or other bodies, available on the purchase of hardware and software. With this new scheme, the question that arises is whether the software selected by the advisers will correspond to that that the teachers would select. The teachers are the users, not the advisers.

Programming Languages

Development

The use of computers in schools commenced with the teaching of programming using the BASIC language. Initially this was in the upper schools in order that the pupils could complete a programming project as part of the examination requirements in computer studies. Possibly because of there being so little educational software available, the microcomputer was also first introduced into middle schools by teaching the children simple programming in BASIC. In-service courses for teacher training in the subject also initially included the teaching of some programming in this language. The value of teachers and pupils being able to program a computer has been realised by many, not least Knuth, who considers that in order to understand something, one has to teach it to someone else. He concludes that an excellent way to understand something fully is to teach it to a computer, i.e. express it as an algorithm (Knuth, 1974). The computer being the dumbest pupil possible requires the most exacting instructions. But, teachers are often referred to as being non-innovative in disposition, and to teach children in lower and middle schools computer programming, may mean curriculum change. It is possible that programming skills could be developed at an early age. Minor problems could be identified, as they arose in the classroom, and subsequently attempts made to solve them through programming, so fitting in with the existing curriculum. Many teachers and children are interested in learning to program a computer, and by participating in this way, they should obtain the greatest degree of control over it. But, besides this benefit, teachers on in-service courses have repeatedly expressed the need to be able to adapt software to their individual classroom

needs. A report entitled, Micrococomputers in Primary Education (Dundee College of Education 1983), re-inforces this point. The teachers had noted that when they had actually written programs, or adapted them, it had led them into thinking in more detail about what they were teaching. It follows that while the role of the teacher or the child, is not envisaged as that of a programmer, benefits should accrue from them having some familiarity with computer programming.

The next controversy that arises relates to the important choice of computer language.

Bigtrak

Many teachers in lower school have found the use of Bigtrak, the programmable toy tank, a means of creating a problem solving exercise for young children. This also offers an introduction to programming a computer. Although a rather unrefined tool in some respects, learning is achieved through its use without formal teaching, hence it forms a comparatively cheap medium for Papert's ideas,(1980).

Computer software has been produced which relates to the use of this educational toy. CRASH is a MEP Primer Pack program (4) whereby the children have to write instructions similar to those required to enable mobilising Bigtrak, and MOVES (5) is another piece of software which enables children to manoeuvre and create design on the screen using similar instructions (Meredith & Briggs 1982). These programs are written using BASIC which is still firmly entrenched as the major language in use in educational computing, but repeated efforts have been made to dislodge it.

BASIC Language Assets

The reasons for the continued use of BASIC in education and why it will probably retain its position are clear.

(i) First 'bundled' software, i.e. it is the language readily provided with the microcomputer. Hence it involves no additional expense.

(ii) It is the language used by children on their home computers.

(iii) Most educational software is still written in it.

(iv) It is exceptionally easy to learn, and accepting that the aim is not to produce computer programmers, perhaps children should not be deprived of the pleasure that so many of them derive from attempting a little programming using BASIC. Watching the satisfaction obtained by seven year olds when they see the results from their programming efforts, even in BASIC, endorses this view. The qualifier to this is that they would probably get more satisfaction from producing the same programs using the LOGO language, but until recently, the 'real' LOGO has not been available for the BBC microcomputer, simply a graphics package.

Criticism of the BASIC language derives from the early versions of BASIC, but gradually the versions available are slowly encompassing all the required facilities that are offered in the favoured languages.

LOGO

The implementation that Papert (1980) advocates for use with children is not Bigtrak, but the Turtle, and the programming language incorporating its use, LOGO, evolved for applications by children, by Feurzeig et al.(1969). Abelson (1982) also considers that children require a language like LOGO, in order to be able to control the computer in a self-directed manner and provide expressive power. LOGO type software has found favour in many lower and middle schools, but this mainly consists of a graphics package written in BASIC. The view has been expressed that a graphics package is all that is required in a lower school. Even with very

young children it is not certain how fast their progress will be, and the possibility may arise for them to use the other facilities offered by the real LOGO. The more important fact is that many of these packages have LOGO in their title, but do not provide the educational advantage that LOGO has been claimed to provide. One package does not develop problem solving skills using a top down approach to programming; a bottom up approach is all that is possible. The core of the LOGO language is its facility for list processing, and if this is not available, its use for language and data handling topics is debarred. The way that LOGO has become associated only with turtle graphics has not helped to reveal its full potential to teachers. They only get a limited view of its educational scope and also of its power as a programming language. The reason for choosing Apple hardware for the Chiltern LOGO Project was because of the full LOGO language being available on that machine (Noss 1983). It was considered important to offer the children taking part in the project, the potential of the full LOGO, although it was realised at the time that all the facilities may not prove to be essential. Work beyond turtle graphics was eventually carried out. Overall it is important that the package is such that it encourages the formation of good techniques.

In a LOGO Report on 'A Term With a Floor Turtle' Maxwell states that the learning the children were doing was directed by themselves. There are many zealous followers of the unstructured approach to learning, favoured by Papert, but it is questionable whether it will have the impressive effect on learning that its advocators envisage. This approach follows Piaget's theory of children learning without being taught. Because of the disappointing results emanating from following this theory, teachers now look beyond it. Learning by self discovery, lacking expert guidance, can

be extremely difficult for anyone and is a slow process. It would be considered to be almost heresy by many, to suggest that the potential of LOGO is best attained in a more structural environment. But, in an unstructured setting, the discovery is left to chance, and some pupils will miss out completely. Researchers at Edinburgh University (Howe,O'Shea & Plane 1980) provided worksheets with set goals to ensure that the children would eventually discover the concepts that were aimed to be taught, as they completed the work. Even adult students at College are not motivated to the same extent when left to provide their own goals. Also the resulting muddled approach that is revealed when they are left to work on a computer programming project alone, points to the importance of guidance. Hoyles and researchers working on the LOGO Mathematics Project at London University's Institute of Education consider that teachers should not provide goals initially for their pupils. In allowing them to explore and try things out for themselves, the researchers state that the pupils build up confidence together with the ability to explore. But when this is accomplished they consider that the teacher can then intervene. When pupils produced Turtleland (Blythe & Noss 1983), a large coloured frieze, using LOGO and the Turtle, Blythe, the class teacher, employed a strategy she termed 'teacher interjection', preferring this to intervention. Program problems were created for the children and help given. She considered that repeated failure was to be avoided, and also that the need was there to pose problems at certain points to lead the children on to further investigation. The children needed these goals and help, even when working with such a motivating tool as a computer. Also, in general, the pupil requires more feedback than the self discovery method provides, even taking into account the feedback resulting from the use of LOGO. The importance of feedback is exemplified in

the Open Learning situation. The added difficulties that the student encounters in this learning method are well realised.

LOGO is gaining recognition as a serious programming language. Digital Research Equipment, the computer manufacturer, is presently promoting LOGO as a language for commercial software. Now that the 'real' LOGO chips are available for the BBC microcomputer, the use of LOGO in schools will probably increase and possibly take over from BASIC for project work in examination courses.

PASCAL

Colleges and schools which are still offering G.C.E.'A' level in Computer Science are now turning to PASCAL for project work. So much indoctrination has taken place relating to the inefficacy of certain languages for beginners, that often it could be assumed that this has overidden technical assessment in many areas. While there are reasons for a decision to change to PASCAL based on the benefits obtainable, there are other considerations which could prove the decision not necessarily correct. Pascal is a difficult, unfriendly language for beginners. Until the present day, many students of 'A' level Computer Science had not previously programmed a computer, and until the situation arises whereby all students have a knowledge of computer programming, a simpler interactive language may be better for first time users. The 'fussy' syntax rules of PASCAL prove very taxing for beginners. Also, mainly being a compiler language, the students find it very frustrating having to wait to recompile each time an error is encountered. While the executable code of PASCAL is certainly quicker than some other languages, for educational use this is not of prime importance. Students and pupils are mainly engaged in the development stage. The benefits of using a simpler language was shown when the B/TEC Higher National Certificate in Computer Studies, in the author's College, changed to PASCAL. Quite

a number of the students, particularly the beginners to programming, experienced more difficulty than in previous years when they were introduced to programming via an extremely good version of the BASIC language. These students already had at least one G.C.E.'A' level and over half were graduates.

Conversely, by using PASCAL, it has proved easier to break the bad programming habits of students, who had previously been taught programming incorrectly. Generally they had used an inferior version of BASIC for their introduction to programming and were new to PASCAL. Also the variety of data structures offered with PASCAL is of importance for students. The facilities whereby lists and trees can be processed is useful for further studies in database structures. The question arises whether the storage available on the BBC microcomputer is sufficient to accomodate the additional space these structures require.

FORTH

This language, written in 1970, was intended to be named 'fourth', the concept being a fourth generation language. Because the machine it was developed on only allowed five character identifiers, the name had to be shortened. It is an unorthodox language as it contains elements of both an interpreter and a compiler. Its main attribute is that the design of the language has been optimized for speed. This was because originally it controlled telescopes and other real time devices.

Despite it being available on ROM and disc for the BBC microcomputer, its advantages particularly in the upper schools, have not been realised; only one teacher, among those contacted for this research, showed interest in using it for control technology. Now the LOGO chip will most likely be used for control purposes in the classroom.

PROLOG

Various attempts have been made to bring PROLOG into the classroom, mainly unsuccessfully. Teachers on a micro-PROLOG course held in the Chiltern area in February 1982 were later interviewed; this revealed that only one teacher had followed up the course by introducing it in the classroom to build a database to clarify certain mathematical concepts. The general feeling was that the language would have to be available in a much more simplified form before it would be suitable for schools.

More interest was shown in the possibilities of using PROLOG with graphics in the classroom (Ball 1983). This implementation of LOGO in a PROLOG context has engendered criticism but initial observation showed that the teachers involved considered the outcome would be of value in the classroom. But, this software may now be redundant with the full implementation of LOGO available on all the machines used in schools. The first attempt, during this research, to observe children using PROLOG with graphics was unsuccessful due to software failure. The software was running when this same class was next observed. Despite the claim that results were produced quicker than other methods, there was a noticeable time-lag. The teacher repeatedly filled this time-gap by explaining to the children that they would have to wait and by giving them further explanations. The children were motivated, but much was due to the way that the teacher introduced a games element into the lesson. Teachers have previously used the same tactics but without the use of a microcomputer. The benefit of using the microcomputer was that the line or angle etc. in question immediately appeared on the screen, this compared favourably to the time taken for a teacher to draw the same on the chalkboard.

A demonstration at Leicester University showed two or more turtles

moving on the screen at the same time. One turtle was controlled by the user. The others moved in related ways or could be scaled in comparison to the turtle controlled by the user. This would enable a pupil to consider the properties of transformation and investigate the combined effects of two or more transformations. But this package is not presently available for the BBC microcomputer. The sprite board is now available, albeit most schools cannot afford it.

A new project, funded by the Research and Development Department of the British library has commenced at Leicester. It is to develop a micro-PROLOG package to allow teachers and pupils, in lower and middle schools, to set up and interrogate databases. This should engender much interest.

The Imperial College project, supported by the Science and Engineering Research Council and the Nuffield Foundation has accomplished a great deal in order to draw the possibilities of micro-PROLOG to the attention of educationalists. This Nuffield project has always concentrated on the use of micro-PROLOG as a language for information storage and retrieval.

A sixth form residential course in micro-PROLOG was another attempt to get PROLOG into the classroom. This proved to be a very successful course but once again with little follow up. But it did show that newcomers to the PROLOG language accepted it better, and found it easier, than those who had previously studied some other programming language. The students who had not done any programming prior to the course were exceptionally interested and took to the language, while others who had programmed previously did not think much of it and found it difficult.

There are various reasons why micro-PROLOG has not found favour in many classrooms. Initially teachers were not even aware of it and

many are still not. Also the first computer language of the majority of those teachers interested in programming has always been BASIC. When introduced to PROLOG they find it very difficult. Besides, originally it was not available on the BBC microcomputer, and initial versions very costly and unfriendly. Developments at the University of Exeter are aimed at redressing this latter reason for non-usage. These researchers have devised what they term 'toolkits'. The user is offered a bridge to micro-PROLOG by the use of a series of commands which supposedly use natural English.

Authoring Languages

If teachers wish to write routines to present information to pupils, request answers and then have the reply interpreted and have a route followed which depends on that reply, they should find an authoring language beneficial. But acceptance of authoring languages has not been widespread. Although they are designed to enable the teacher to produce their own educational software, it is at a superficial level. The result would be a very restricted, text based, tutorial system of the programmed learning type. More advanced use requires a professional approach. To get the real benefit, full scale versions must be used and, ultimately, in conjunction with video disc technology. No version of PILOT, at the present time, is available for the BBC microcomputer but Microtext, mainly text based, and designed by the National Physical Laboratory is available. None of the schools contacted for this research have used it. Even if schools had the expertise required to use the language in conjunction with a video disc, they could not afford the latter. But video cassette players are in general use in schools, and even the overhead projector can be used in conjunction with Microtext. While this usage is stated in the documentation, no instructions are provided as to how to combine the two. With

Microtext Plus, expert system techniques incorporating generative rules are promised. But the estimated cost of Microtext Plus will prove to be prohibitive for most schools.

Conclusion

LOGO may be the better language for teaching children procedural thinking, i.e. how to do things, but Micro-PROLOG is good for teaching them descriptive thinking, i.e. how to describe things. But, O'Shea and Self (1983) state, "...it is very likely that a range of languages and environments will be developed which will recognise the difference in cognitive development of children of different ages.

The Alvey Report on Advanced Information Technology recommended that languages should be chosen with an eye to the future. But, the slow acceptance of languages other than BASIC in the classroom leads to the conclusion that BASIC will still be used for some time yet. It has gained much support in recent years in industry too. Experiments carried out at the National Computing Centre using expert system techniques have been written in BASIC.

CHAPTER 4. CONCLUSIONS

This final chapter describes the findings resulting from the research. They relate to the areas which were specified for investigation in the abstract. Topics which warrant further research are then expanded. Lastly the areas of the research which could be criticised are examined.

FINDINGS

Primarily this research was to focus attention on the pedagogy involved in this innovation. It was to determine whether the microcomputer was a possible agent of change for teaching methods in the school. In most schools the teacher is still, fundamentally, an agent of transmission. This long established role of imparting knowledge is a habit not easily broken; pupils help to perpetuate it through constant feeding.

The method employed to introduce the microcomputer into schools must largely be dependent on the software in use. Research carried out during 1982 showed that the type of software used followed explicitly the traditional style of teaching, and was very dependent on initial expository learning. Much was of the programmed learning kind, adopting the theories of learning of the behavioural psychology of Skinner. This introductory approach, following a familiar pattern of teaching, has been considered to be one reason for the non-rejection by the teacher of the microcomputer in the classroom. But, much of this software was inferior.

Some programming in BASIC was also being taught at that time. The teaching of programming was ultimately discouraged for younger children. Besides providing the greatest degree of control of the computer, this also enhanced the educational process more than much, so called, educational software. The problem analysis and solving stages of computer programming fulfil Bloom's (Gronlund 1970)

cognitive domain objectives well.

Although there may be no conclusive proof about what is precisely learned from simulations (Self J. 1985), in earlier research with undergraduate students, Laurillard (1978), claimed that this type of software proved to be of value educationally. The introduction of this software in schools for the lower age range, around 1983, was an improvement on previous software. Simulations do force the user into a decision making situation and do not involve passive learning. But, activity in itself does not teach problem solving skills which are considered an important pedagogical task, as are the underlying concepts. Simulations encompass simple problem solving, hence cognitive development and concept aquisition can be claimed by their use. The observed usage of this type of software showed that when the children were working in groups it broke the habit of the child depending so much on the teacher, it involved role play, and it enabled the use of the microcomputer across the curriculum.

The introduction of a games element into educational software has proved to be a controversial issue, many teachers considering it detrimental to the success of the microcomputer in the classroom. Others eventually found the adventure game particular useful for the English lesson. But the educational effectiveness of educational games has still to be determined. Malone T. (1980) considered computer programming to be one of the best computer games. Following this premise, if educational value can be attributed to computer programming, then it can be attributed to computer games. The increasing use of a LOGO type software in 1983 further helped the development of problem solving skills and discovery learning. A group of children were observed who were left with this type of software without any direction and they soon got bored with creating

their own examples. They regained interest on receiving further ideas, thus making it clear that guided discovery learning is often required.

If the LOGO environment was pursued to facilitate the exploration of various subject areas there are fears that it could have unpleasant side effects (Self J.1985). Self recalls how Papert advocates that a child learn mathematics 'naturally' by communicating with a computer, as French children learn French by living in France. He wonders about the alienating effect on the child if they have to spend as much time in 'Computerland' as French children do in France; particularly if other subjects were learned in this way too.

During 1984, although the major type of usage of the microcomputer still consisted of drill and practice type software, the teachers were very critical of it, and its novelty appeal was lessening. But they saw the benefit and appeal of it for the slow learners and for testing and re-inforcing work with children who regarded it as a game. They were beginning to think about how the microcomputer could be used to develop children's thinking skills, to stimulate and involve more child-centred learning. The use of word processing software was found to enhance communication skills and the use of database query software introduced serendipity learning, whereby the pupil gains knowledge by being proficient at browsing through a database.

In 1985 the adventure game, associated with simulations, began to be used more often and are gaining popularity. This type of software provides an environment for learning, and a break away from didactic teaching methods and receptive learning.

Hence, while the pedagogical approach of this innovation still mainly follows the traditional method of teaching, the gradual

infiltration of new software is slowly bringing about a change in the classroom. More reliance is being placed on process rather than static knowledge to comply with a changing environment. Skills are being developed rather than the more easily tested knowledge. The emphasis is moving from the behavioural to the cognitive theory of learning. The learners are being given greater freedom to explore ideas, and gradually are being placed more in control of their own learning. The use of authoring languages; albeit more suited to behavioural models of learning, do enable pupils to select the instructions that they wish to receive.

Societal Needs

In recent years much effort has been expended to provide pupils with the skills required for their future roles in society. In the upper schools, new skills are being taught on the courses in pre-vocational education. A major part of these courses is concerned with training in computing skills. Research carried out in schools revealed more usage, particularly in the upper schools, of commercial software. These schools are attempting to dispense with the G.C.E. 'A' and 'O' level courses in computer topics. One reason expressed for dispensing with the 'A' level is that universities have stated that they do not wish applicants for computer science degree courses to have studied the subject at 'A' level. But pupils who are successful in this examination, and who do not wish to continue to university are sought by employers in the computer industry. A finding of the National Computer Centre's 1985 annual survey was that the skills shortage in Britain's Computer Industry was likely to worsen in 1986.

Controversy however prevails over the inclusion of any pre-vocational education in schools. It has been said to distort the curriculum and there has been concern over the intake of untrained

teachers and the assumed gender bias associated with these courses. But many of the skills taught on these courses are not merely skills for the work situation, but pertain to all activities within communities, i.e. both social and life skills. The social skills encompass training to prepare individuals to conform to work situations. The emphasis with life skills is to enable the individual to have more involvement, pursuing a more cognitive approach in obtaining skills.

Youth unemployment has been a catalyst for more industrial involvement in education. The experience of Cullington (1984), has led to the conclusion that this involvement enhances education. It is generally accepted that a teacher who has had work experience before entering the teaching profession can offer more than those teachers who entered the profession without this experience. Besides this, teachers who have had no industrial or business experience are now expected to introduce topics in the classroom which relate to such experience, unaided. Whether industrial involvement enhances education, or otherwise, these teachers need this support, if pre-vocational education continues. More sabbatical leave is required for teachers to attend the new courses aimed to provide them with a better understanding of industry, including the commercial and service sections. These courses include a period of industrial attachment. Surprisingly, there was no evidence of any liaison with local computer industries and the schools which had won the curriculum award. The criterion for the award was, presumably, based on the degree of liaison with the local community.

Gender Differences

The gender difference in the attitude to using computers starts around the age of seven and continues from thereon. Hence, this is not a biological sex difference, but a socially imposed one by the

home and school environments.

The new courses in the upper schools incorporating the use of commercial type software are inculcating more interest from the girls. This is said to further sex stereotyping. It may be a catalyst, if carefully manipulated, for persuading girls to consider studying further computer subjects, once the initial apprehension of using the computer has been overcome. This does not eradicate the underlying entrenched cause for the development of the early change in attitudes. One teacher expressed the opinion that when children had been used to operating the microcomputer from an early age and continued to do so through their schooling, the gender difference in attitudes would fade; but the gender difference is not only found with computer topics.

Research in independent schools showed more girls from these schools were taking examinations in computer topics than girls from state schools, but the sample was small. A survey carried out by the University of Surrey in 1984, also pointed to the fact that these girls had more computer experience than girls from state schools. But, the Open University research showed that girls attending the TVEI schools in Bedfordshire were opting for non-traditional option choices.

Problems

The major problem in the middle and lower schools has been the shortage of microcomputers and having to transport all the equipment to each classroom when required. This combined with the time taken to set it all up, and the associated danger arising from the conglomeration of wires required for the various peripherals often disuades teachers from using it. But it has not deterred the lower school teachers from using it, albeit the problem is not so acute in these schools. Many are situated on one level, and more time is

available with a flexible time table in operation. The shortage of monitors has not engendered the use of the microcomputer as an electronic blackboard. Security of equipment has created more problems for schools.

Scarcity and quality of software has been another problem. The need to view the software first before purchasing it has been expressed. The teachers complain that this facility is not available, and resent the software being locked, so that they are not able to modify it to their own special needs. Schools that have purchased networks have found additional problems, in that their existing software has not been compatible with the network system.

The lack of training in the use of the microcomputer in the classroom has repeatedly been expressed, together with initial difficulty in being allocated places on courses. The result has been much dependence on help from pupils. Keyboard difficulties have been expressed but not unduly so. Some teachers have experienced a manning problem, in having to look after an additional group of children using the microcomputer.

Software

Throughout the research the quality of educational software has received much adverse criticism, but the teachers have eventually weeded out the type that they considered to have little educational value and now use a selected few. Initially software was extremely scarce, so teachers wrote their own. Because drill and practice exercises were so easy to transfer to computer programs, an abundance of this type was written. Also because this kind was easy to write, the expertise required to write good software was not realised. Subsequently software was written without the accompanying analysis, design and testing stages. The result was often unreliable and badly designed software.

But, given the required expertise, the microcomputer used in schools proved a hindrance to writing good software. This is expanded below.

Equipment

Despite its limitations, all the teachers contacted in this research have been well pleased with the microcomputers used in their schools; the majority being the BBC model. But, it is unsuitable for future educational software requirements. Investigation into existing software shows it to be deficient in many ways, mainly due to the machine's meagre user storage allowance. Programs are often badly structured, statements being so compressed to save space that they are undecipherable. Userfriendliness has to be sacrificed because of the additional amount of storage required to achieve a reasonable level. One of the main attributes of the BBC microcomputer has always been considered to be the graphics. Advantage cannot always be taken of it, particularly use of the high resolution graphics, except for very small programs, again because of limited storage.

Good pictorial presentation, userfriendliness, and well structured, reliable programs which are easily modified are essential for computer aided learning programs. Many of the programs reviewed have fallen down on these requirements, hence the conclusion that they have not helped the case for computer aided learning.

This microcomputer cannot possibly facilitate the requirements for the software of the future. It can be argued that with all the add-on devices available, the memory can be extended. But 16-bit microcomputers will be required, not only for their greater speed and larger memory, but for the multi-tasking facility they offer; particularly for applications pertaining to control technology.

However, it is the user who decides which technology to adopt. At present, commercial users are satisfied with 16 bits and teachers are satisfied with 8 bits. Hence it is highly probable that these 8-bit microcomputers will still be dominating school computing for many years. They could be better utilised simulating terminals connected to a large mainframe.

Evaluation

Despite all the problems the teachers have had to overcome, they have found a use for the microcomputer in the classroom and continue to use it. Evaluation has not taken place, but in order to do this objectives must be defined in order to ascertain if they have been fulfilled. Without any direction the teachers have taken it into their own hands to decide what to do. The advice of Barrow (1985), that we should put teaching back into the hands of the teachers, has been followed.

Although there is still euphoria about using microcomputers in the classroom, a stage has now be reached where more thought is going into how they should be used. The situation has followed the pattern usually encountered in the life cycle of an innovation. The adoption rate is slow initially, then speeding up in the middle period, followed by a slow period again. This final slow period is required in order to review the situation and determine which path to follow next.

Future Research

It may be possible to attempt a superficial evaluation of the effect of using the microcomputer in education, on children's learning in the short term. The question of the effect in the long term has still to be addressed. Hence, the need for long term research to assess the effect of the computer in the classroom on children's learning as recommended by Sage and Smith (1983). They also succinctly state: 'We cannot afford to spend decades groping blindly for the key to effective educational use of computer-based information technology'

In the experimental stages of educational software production, it was perhaps permissable to allow an assortment of software to mushroom. Now that teachers are beginning to select specific packages from the 'rubble', research into the evaluation of educational software is more viable. But, this may require the objectives of each software package to be precisely defined. This relates back to the behaviouristic view of CAL, incorporating a rather narrow view of education. Research into evaluation taking a more cognitive perspective may be more beneficial. This would entail using software which differed from the convential CAL type, for example, some form of intelligent tutoring (ITS) or intelligent knowledged based system (IKBS).

It is considered that it will be some time before these systems, which react 'intelligently' to the needs of individual learning, will be used in schools. They are stated to require resources of computing and expertise not to be found in education. This may not be entirely true; the hardware required to develop simple expert systems is now available for schools. The RM Nimbus memory can be extended to one megabyte, with add-on memory cards, and the discs

used hold 720K of storage. So, small versions of ITS or IKBS are possible, albeit at a prohibitive hardware cost. Admittedly the expertise required for the design is lacking but teachers are surely experts in their profession.

The possibility of using expert systems techniques should be a viable one, when the facility is combined with authoring systems. Teachers who were taught programming stated that it had made them think more about the teaching problem. Defining and structuring knowledge for an expert system also helps the expert to think more clearly about the domain in question. Once the knowledge bases were built for the children to interrogate, the teachers would benefit by having more time for creative work. As PROLOG becomes more integrated in the classroom, so the possibility of these systems becoming a reality is also more viable. These systems have already been produced successfully for use in schools as part of the Imperial College project, previously stated. Children observed using them were more interested in asking the system how it had reached the answer it had arrived at, rather than the question itself.

The main difficulty lies in the interaction. The simple systems used in schools may be expected to offer a poor interface between the child and the system. Also the child will not be as proficient as some adults in using precise terms. Hence the need for research into natural language processing but also for systems that can accommodate imprecision. There are many areas in education for the use of expert systems. The grading and assessment of pupils could be better accomplished by the use of such systems. As the expert system could be used by teachers to clarify their thoughts, so it could be used as part of the learning experience. The children could be the experts and write their own knowledge base.

The commercial sector has now realised the value of expert systems

and artificial intelligence in general. Researchers may be lured into this sector, by the higher salaries offered, to the detriment of academic research in this area.

Finally research is required into the increasing problem associated with the differing sex attitudes to using computers. Initially in the lower schools the girls are almost over-confident in using the microcomputer, compared to the boys, yet in the final year the boys are beginning to dominate its use and this continues in the middle and upper schools. The reason for this change is a subject which requires researching. The number of girls entering computing courses in higher education is now diminishing.

Criticism of Research and Limitations

As with any research into an on-going situation, the problem lies in deciding when to terminate it. Inevitably, new facts are emerging every day. But, it would seem that the stage of the innovation has been reached where there is now a pause which should enable educators to take stock of the situation and decide on the best way to continue. It may be that this research was premature; a further time lapse being required before being able to ascertain if the innovation was proving to be an agent of change. More comparisons between the methods employed and attitudes of those teachers who had been using microcomputers for some time and those less experienced users may also have been more beneficial. This would have determined whether any changes could be observed.

In 1984 about one fifth of British households owned a microcomputer. The use of the personal microcomputer as a home tuition tool was not followed up in any major way in this research. Undoubtedly the potential is there. Tom Stonier of Bradford University foresees the home computer being utilised for educational purposes and the teachers ultimately performing a different role (Stonier 1983). During the research period students and pupils were asked if they possessed a home computer and if so the mode of usage employed. Without exception, the answer to the latter question was solely for games playing. Hence the reason for not pursuing this topic, apart from the time factor involved.

While the study of control technology was increasing in schools, there was only one occasion when it was encountered in this research. This important area is therefore omitted in this thesis.

The research was delayed, due to the long waiting period experienced by the schools in obtaining a microcomputer. The

possibility is that too much was attempted in the time remaining for completion of the thesis. A vast amount of data was eventually collected.

The use of the microcomputer for administration purposes was not considered. But this usage has implications in education for pupil record keeping. It could effect the teaching methods of the future. The needs of individual learners are based on previous performance. Record keeping also affects children's privacy. With the enforcing of the provisions of the Data Processing Act, the microcomputer can be considered an agent of change in one respect; the students and pupils will ultimately be entitled to view their computerised records. Teacher's awareness of this could affect their teaching methods.

There was continuity of research in the Chiltern area schools but ideally there should have been more follow up, in the other two areas. Time was not available to do this in 1985.

Finally the harmful effects that may be attributed to the use of the microcomputer in the classroom was mainly neglected. Whether its use will enhance the quality of education, needs to be considered. The conclusion reached after viewing some computer based material might be that it may set teaching back a few decades. The education system has also been considerd to be in some danger arising from the introduction of pre-vocational training in the classroom. The health aspect is another area for concern, particularly from extended viewing of a visual display screen; the compulsive computer user is commonly encountered. Teachers have been stated to be suffering from stress in attempting to cope with the microcomputer in the classroom. Some have been concerned about job security.

The possibility of a resulting alienating effect on pupils and students due to communicating with a machine has been realised.

Human interaction is considered an important part of psychological development. Papert, working on the project called "Word Worlds" foresees the danger of children being deprived of such human interaction. This project employs the use of an expert system which controls a database which the children can interrogate. The information is illustrated on a videodisc. Papert has suggested that a generation reared on knowledge supplied from machine sources might produce psychotics.

Personal Views

On completion of this research I conclude that while the use of the microcomputer in the classroom has been a catalyst for change, I hold a pessimistic view relating to its future use in some schools. The machine is often left idle in middle schools. It has been found to be an ideal resource for lower schools mainly due to the relatively flexible curriculum. The curriculum changes that are planned will mean these schools will lose the freedom that enabled them to explore the use of the microcomputer. At the upper level, the machine should be used for some years yet as a tool, and provide access to knowledge that is not so readily available from textbooks. The eventual introduction of expert systems, ITS and IKBS should prove beneficial to learning, because a greater understanding of learning will be necessary before learning can be automated.

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APPENDICES

APPENDIX A

Questionnaires and Results 1982

A1-A8

Questionnaire 1

BBC MICROCOMPUTER AND LITERACY PROJECT EVALUATION Jan.1982.

To complete, please tick the relevant circle, when provided, otherwise give textual answers.

1. THE BBC MICROCOMPUTER:

(a) What do you consider its major attributes?

(b) Its weaknesses?

2. SOFTWARE:

(a) How would you describe educational software that you have used to-date?

GOOD	AVERAGE	BAD	NONE USED
o	o	o	o

(b) From your first impression, do you consider that the BBC software will be:

GOOD	AVERAGE	BAD	DON'T KNOW
o	o	o	o

3. BBC BASIC:

(a) Have you seen the National Extension College 30 hour BASIC book?

YES	NO
o	o

(b) Do you consider that the BBC BASIC compares favourably with other versions of BASIC?

YES	NO	DON'T KNOW
o	o	o

4. BBC TELEVISION SERIES:

(a) Do you consider the proposed contents will achieve its aim of computer literacy?

YES	NO	PARTIALLY
o	o	o

(b) Do you consider the contents:

OVER AMBITIOUS	RIGHT LEVEL	TRIVIAL	OTHER
o	o	o	o

(c) Are the broadcast times satisfactory?

YES	NO
o	o

(d) Should the BBC have included the teaching of BASIC more fully in the series?

YES	NO
o	o

5. BACKGROUND DETAILS:

(a) Please state the type of computer courses you have taught in the past, if any:

(b) Computer languages used:

(c) Which manufacturer's version of BASIC have you used?

(d) If you would be kind enough to consider offering you help again at a future data, please conclude by adding your name and either home or school/college address.

THANK YOU

NAME.....

ADDRESS.....

.....

.....

SUMMARY TABLE:Questionnaire 1.

Question	Response	No. Selecting Response
machine's greatest attributes	graphics	10
	cost	8
	facilities	6
machine's weakest points	availability	7
	storage offered	5
	use of 6502	2
impression of courseware in general	bad	6
	average	5
	none used	11
impression of BBC software	average	6
	good	3
	don't know	11
impression of BBC BASIC	compares well	15
	don't know	6
level of courses taught	low	9
	medium	5
	high	4
languages used by lecturer	many	4
	medium	7
	two	4
versions of BASIC used	two to four	4
	five or more	13

Questionnaire 2.

Microcomputers in Primary Schools

Please answer the following questions by either ticking the relevant answer or verbally as required.

1. Do you have a microcomputer in your school?

YES NO

if YES continue with Q.2 if NO jump to Q.6

2. Is the microcomputer used:

(a) in teaching (b) for adminstrative work (c) for both a&b?

OR is it not used at all?

3. If it is used in teaching, can you briefly specify how?

4.If it is used for administrative work, could you list the type of work?

5. If it is not used at all, can you give the reason why?

Now go to Q.10.

6.Do you expect to get a microcomputer:

(a) in the near future?

(b) sometime?

OR do you really not wish to use one?

7. If you do expect to get a microcomputer, do you have any preference for a particular one? YES NO

8. If answer was YES to Q.7, which one?

9. Can you give reasons why you prefer this one?

10. Do any of your staff use microcomputers, perhaps at home etc., to your knowledge? YES NO

if YES how many?

THANK YOU FOR YOUR CO-OPERATION.

Questionnaire 2

SUMMARY TABLE: Primary School Teacher's Responses

Question	Response	No. selecting response
micrcomputer in school	yes	2
	no	37
no wish to obtain one	correct	9
expect to get one sometime	yes	10
any specific one	no	10
keen to obtain a BBC one	yes	20
	no response	5

Questionnaire 3.

BBC COMPUTER EVALUATION:College Lecturers

To complete please tick the relevant circle, when provided, otherwise give textual answers.

1. Is this the first time that you have used a computer?

YES	NO
o	o

If YES continue with Q.2 If NO continue with Q.4 **

2. Did you know the BASIC language previously?

(a) YES	(b) VERY LITTLE	(c) NO
o	o	o

If (a): does this BASIC differ at all from other versions of BASIC that you know of?

YES	NO
o	0

If YES, is it an improvement?

YES	NO
o	o

If (b) OR(c): what did you find most difficult about using the language?

3. What did you find most difficult about using this computer?

NOW CONTINUE WITH Q.7

**4.What other types of computer have you used?

5.Compared with other computers what did you consider to be:

(a) the greatest asset of this machine?

i) for personal use?

ii) as a teaching resource?

(b) the major drawback of this machine?

i) for personal use?

ii) as a teaching resource?

6. Is the BASIC used any improvement on other versions of BASIC that you have used?

YES NOT USED ANY NO

o o o

If YES in what way?

7. Do you consider the BASIC language an ideal language for use in schools and colleges?

YES POSSIBLY NO DON'T KNOW

o o o o

8. State a reason for your choice of answer to Q.7.

9. If you do not think BASIC an ideal language for use in schools and colleges, can you name one which you consider may be better and give the reason why.

10. Do you consider that there is a need for microcomputers in:

ALL SCHOOLS? UPPER ONLY? MIDDLE ONLY? PRIMARY ONLY? OR, NO NEED?

o o o o o

11. If you consider that there is a need for microcomputers in schools, what function should they provide:

TEACHING AID? LEARNING AID? ADMINISTRATION? COMPUTER AWARENESS?

o o o o

12. If you were to use the machine in your teaching, how would you use it?

IF YOU WOULD CONSIDER HELPING AGAIN AT A FUTURE DATE PLEASE CONCLUDE BY ADDING YOUR NAME AND SCHOOL.

Thank You.

NAME.....

SCHOOL.....

Questionnaire 3.

Summary Table: college lecturer's responses.

Schools represented	No.	Machine's assets	Machine's drawbacks	Suggested uses
Humanities	2	keyboard, graphics, BBC influence	cost, lack software	simulation & decision making, problem solving
		portability	program loading	spelling
Engineering	2	teaching resource	saving programs	teaching programming
		portability, graphics	break key position	graphics, animation, numeracy, literacy
Business	1	keyboard, colour	program loading, display problem-large groups	teacher/ student awareness
Education	1		loading programs	teacher modifiable software

APPENDIX B

Questionnaires and Results 1983

B1-B3

Questionnaire 4.

BBC MICROCOMPUTER & SOFTWARE EVALUATION.

To complete, please tick the relevant circle when provided, otherwise give textual answers.

1. How many BBC microcomputers do you have in your establishment?

2. Do you have Model A's, B's, or upgraded A's.

3. Give details of peripherals and any additional options in use with the BBC microcomputer.

4. Specify any problems encountered at the initial setting up phase of the BBC microcomputer, peripherals, or additional options.

5. Details of any problems encountered with this hardware since the initial setting up phase.

6. Name any other types of microcomputers used in your establishment.

7. Overall, does the BBC microcomputer offer more, as an educational tool, than the other types of microcomputers used?

YES	NO	SAME
o	o	o

8. If answer to question 7 was YES, what do you consider the BBC microcomputer's major asset to be?

9. If answer to question 7 was NO, what do you consider the major asset of the other microcomputer(s) to be?

10. Name the courses that are making use of the BBC microcomputer in your establishment.

11. What is the BBC micrcomputer mainly used for, in your establishment?

12. Has it proved to be useful for any specific task, even though not generally used for this purpose?

YES	NO
o	o

If answer YES, name the task.

13. Are any other lecturers making use of the BBC microcomputer?

YES NO

o o

If answer YES: (a) how many?

(b) in what way?

(c) has the purchase of the BBC microcomputer led to an increase in the use of a computer by other lecturers in general?

YES PARTIALLY NO

o o o

14a. Where is/are the BBC microcomputer(s) sited within your establishment?

b.Are they available for general use by any memeber of staff and any student?

YES RESTRICTED NO

o o o

If answer positive, do the students take advantage of this and make use of the facility privately?

YES PARTIALLY NO

o o o

15. do the users find the sytem, user friendly?

EXTREMELY MODERATELY NOT AT ALL o o

o

16.What is the general opinion amongst your users of the BBC version of BASIC?

GOOD BETTER THAN MOST POOR

o o o

17. What is the general opinion among the lecturers at your establishment of educational software that is available for the BBC microcomputer and used by them?

18. Are there any other languages in use on your establishment's BBC microcomputer, other than BASIC?

YES NO

o o

If so please name them.

If answer is NO, does your establishment intend using any others?

YES NO

o o

If there are any other details,please include them.THANK YOU.

SUMMARY TABLE:Questionnaire 4.

Average no. of BBC micros per college:	6
No. of RML microcomputers in use:	9
No. of others in use:	12
	No. of colleges.
Peripherals in use:	
disc drives	5
printers	3
Using networks:	3
Main problems:	
due to delay in receiving equipment	5
due to cassette usage	4
BBC micro offers more as an ed. tool:	
yes	3
no	1
same	1
BBC microcomputer-major asset:	
graphics facility selected	6
Increased usage due to BBC microcomputer:	
yes	3
partial	3
none	2
Availability for lecturers and students:	
general	5
restricted	2
not available	1
Extensively used by students:	8
Finds system user friendly:	
extremely	1
moderately	6
Opinion of BBC BASIC:	
good	1
better than most	5

APPENDIX C

Questionnaires and Results 1984

C1-C19

Questionnaires:A,B,C,D.

MICROCOMPUTERS IN SCHOOLS

Please answer the following questions by either ticking the relevant answer or verbally as required.

1.Type of school: No. on roll:

Lower? Middle? Special Education? Preparatory? Other?

2.Do you have a microcomputer in your school:

YES? NO?

if yes continue with question 3 if no continue with question 22

3. Complete the following:

The microcomputer(s) is/are used for:

Teaching and/or Administration

Number:

Make/Type:

4. In what way is the microcomputer used in teaching:

Electronic blackboard Small groups of pupils? Individual use? involving the whole class.?

5. Please specify any other method?

6.How often is the microcomputer used in teaching:

e.g. every morning? twice weekly? etc. Please specify.

7. Currently, are only one or two members of the staff mainly using the microcomputer in teaching:

YES? NO?

8. If NO, what proportion of the staff do use the computer in teaching?

9. If the teachers who use the computer are not class teachers please specify the special subjects that they teach.

10.Do you, or do you intend to, have a teacher responsible for computer education:

Already have? Intend to? Do not intend to?

11. Have the members of staff shown eagerness/ willingness to attend in-service courses in educational computing:

YES? PARTIAL? NO?

12. If the answer was other than NO, have they experienced difficulty on getting on any such courses: YES? NO?

13.Where do you mainly keep your microcomputer(s):

Special room? Each classroom as required?

14. Are they locked away:

(a) when not in use?

(b) after school hours only?

15. How is your school situated:

One level? More than one level?

16.Specify the class years that use the microcomputer(s):

First? Second? Third? Fourth? Other? All?

17. What type of educational software do you have and how much:

Software provided by the LEA only?

Software obtained independently:

NONE? ONE OR TWO? ABOUT TEN? ABOUT TWENTY? THIRTY OR MORE?

Software written by the staff or pupils:NONE? ONE? ABOUT FIVE?

ABOUT TEN? MORE?

Details of other sources?

18.What are the most useful pieces of software used by the school?

19.Has there been any noticeable differences between the approach of the girls when using the microcomputer and that of the boys:

YES? SLIGHT? NO?

20. If the answer was other than no, please extend.

21. What has been the greatest problem encountered in using the microcomputer in school so far?

22. What is the general opinion of the staff of the educational software available?

23. What is the general feeling of the staff towards the use of microcomputers in schools?

24.Do you consider it important that a school should have microcomputers:

YES? NO?

25. Please expand your answer to question 24.

26.Do you consider that some form of computer appreciation/awareness should be part of the curriculum for your type of school?

27. Any other information would be appreciated. THANK YOU.

Summary Table:QUESTIONNAIRE A1

Respondents: teachers from special schools in the Chiltern area.

Number sent: 15

Number returned: 15

Note. The numbers below relate to the number of schools.

Microcomputers in usage

No. of schools with:	14	No. without:	1
Total no.:	35	No. of BBC's:	17

Method of usage

Electronic blackboard:	5	Small groups:	13
Individual use:	12	Administration:	0

Amount of usage and availability

Every day:	9	Once weekly:	1
Twice weekly:	1	All classes:	11

Computer situated:-

Special room:	7	In classrooms:	8

Locked away:-

When not in use:	3	After school hours:	7
School on one level:	11	More than one level:	3

Gender differences in use of computer

No difference:	9	Slight difference:	2

Staffing

Teacher for computing: 11 Intend to: 1 Do not intend to: 1

Opinions of staff

Computer important in school?

Positive:	13	Negative:	1

Computer awareness should be part of curriculum?

Positive:	12	Negative:	0

Software

No. purchased independently: 20 or more: 5 10 or less: 7

No. written by staff or pupils:

10 or more: 6 5 or less: 4 none: 2

LEA provided only: 1

Summary Table:QUESTIONNAIRE A2

Respondents: teachers from special schools in Cumbria.

Number sent: 8

Number returned: 8

Note. The numbers below relate to the number of schools.

Microcomputers in usage

No. of schools with:	6	No. without:	2
Total no.:	10	No. of BBC's:	6

Method of usage

Electronic blackboard:	1	Small groups:	5
Individual use:	6	Administration:	1

Amount of usage and availability

Every day:	5	Once weekly:	1
All classes:	5	Selected classes:	3
Computer kept in special room:	2	Kept in classrooms:	3
Locked away when not in use:	1	After school hours only:	6
School on one level:	8	More than one level:	0

Gender differences in use of computer

Girls approach different:	1	No difference:	4
Slight difference:	1		

Staffing

Teacher for computing: 4 Intend to: 1 Do not intend to: 1

Opinions of staff

Computer important in schools? Positive: 5 Negative: 0

Computer awareness should be part of curriculum?

Positive: 5 Negative: 0

Software

No. purchased independently:

20 or more: 2 10 or less: 4

No. written by staff or pupils:

10 or more: 3 none: 1

LEA provided only: 0

Summary Table:QUESTIONNAIRE A3

Respondents: teachers from a Curriculum Award Special school.

Number sent: 1

Number returned: 1

Microcomputers in usage:

Total no.: 1 No. of BBC's:1

Amount of usage and availability:

Once or twice a week:selected classes:older groups.

Kept in classrooms.

Locked away after school hours only.

School on one level.

Gender differences in use of computer:

Girls approach slightly different.

Staffing:

Teacher for Computing.

Software

No. purchased independently: 10 or less.

No. written by staff or pupils:none

Summary Table:QUESTIONNAIRE B1

Respondents: teachers from lower schools in the Chiltern area.

Number sent: 24

Number returned: 17 (three returned school closed).

Note. The numbers below relate to the number of schools.

Microcomputers in usage

No. of schools with:	10	No. without:	4
Total no.:	12	No. of BBC's:	11

Method of usage

Electronic blackboard:	6	Small groups:	9
Individual use:	6	Administration:	0

Specific usage:

Amount of usage and availability

Every day:	9		
All classes:	6	Except year 1:	3
Computer kept in special room:	3	In classrooms:	7
Locked away when not in use:	0	After school hours only:	9
School on one level:	5	More than one level:	3

Gender differences in use of computer

Girls approach different:- No difference: 8 Difference: 1

Staffing

Teacher for Computing: 4 Intend to: 2 Do not intend to: 3

Staff willingness to attend computing courses:

Positive: 8 Partially: 4

Places available: yes: 4 no: 6

Opinions of staff

Computer important in schools?

Positive: 11 Negative: 0

Computer awareness should be part of curriculum?

Positive: 7 Negative: 1

Software

No. purchased independently: 20 or more: 2 10 or less: 4

No. written by staff or pupils: 5 or less: 2 none: 3

LEA provided only: 4

Summary Table:QUESTIONNAIRE B2

Respondents: teachers from lower schools in Cumbria.

Number sent: 20

Number returned: 14 one not completed.

Note. The numbers below relate to the number of schools.

Microcomputers in usage

No. of schools with:	12	No. without:	2
Total no.:	12	No. of BBC's:	11

Method of usage

Electronic blackboard:	5	Small groups:	10
Individual use:	6	Administration:	0

Amount of usage and availability

Every day: 7 All classes:	6	Selected classes:	4
Computer kept in special room:	0	Kept in classrooms:	10
Locked away when not in use:	1	After school hours :	7
School on one level:	8	More than one level:	3

Gender differences in use of computer

Girls approach different:	0	No difference:	7
Slight difference:	1		

Staffing

Teacher for Computing:	5 Intend to:3	Do not intend to:	1

Opinions of staff

Computer important in schools?

Positive:	11	Negative:	1

Computer awareness should be part of curriculum?

Positive:	11	Negative:	0

Software

No. purchased independently:

20 or more:	1	10 or less:	6

No. written by staff or pupils:

10 or more: 1	5 or less: 3	none:1	LEA provided only:	2

Other sources: none.

Summary Table:QUESTIONNAIRE B3

Respondents:teachers from the Curriculum Award Lower schools.

Number sent: 14

Number returned: 7

Note. The numbers below relate to the number of schools.

Microcomputers in usage

No. of schools with:	5	No. without:	2
Total no.:	6	No. of BBC's:	6

Method of usage

Electronic blackboard:	2	Small groups:	5
Individual use:	5	Administration:	0

Amount of usage and availability

Every day:	3	Very infrequently:	1
All classes:	4	Selected classes:	1
Computer kept in special room:	2	Kept in classrooms:	4
Locked away when not in use:	2	After school hours:	4
School on one level:	5	More than one level:	1

Gender differences in use of computer

Girls approach different:	0	No difference:	5

Staffing

Teacher for Computing:	3	Intend to:	0	Do not intend to:	3

Opinions of staff

Computer important in schools?

Positive:	4	Negative:	2

Computer awareness should be part of curriculum?

Positive:	3	Negative:	2

Software

No. purchased independently:

20 or more:	1			one or two:	2

No. written by staff or pupils:

10 or more:	1	none:	2	LEA provided only:	2

Summary Table:QUESTIONNAIRE C1

Respondents: teachers from the middle schools in the Chiltern area.

Number sent: 13

Number returned: 8

Note. The numbers below relate to the number of schools.

Microcomputers in usage

No. of schools with:	8	No. without:	0
Total no.:	35	No. of BBC's:	30

Method of usage

Electronic blackboard:	8	Small groups:	8
Individual use:	7	Administration:	1

Amount of usage and availability

Every day:	3	25% usage:	5
All classes:	7	3rd.&4th.years:	1
Computer kept:			
Special room:	5	Each classroom:	4
Locked away when not in use:	1	After school hours only:	7
School on one level:	2	More than one level:	6

Gender differences in use of computer

Girls approach different:	4	No difference:	2
Slight difference:	2		

Staffing

Teacher for Computing: 7 Intend to: 0 Do not intend to: 1

Opinions of staff:

Computer important in schools?

Positive: 8 Negative: 0

Computer awareness should be part of curriculum?

Positive: 5 Negative: 0

Software

No. purchased independently: 20 or more: 5 10 or less: 3

No. written by staff or pupils:

10 or more: 1 5 or less: 4 none: 3

LEA provided only: 0

Summary Table: QUESTIONNAIRE C2

Respondents: teachers from the middle schools in Cumbria.

Number sent: 13

Number returned: 11

Microcomputers in usage

No. of schools with:	11	No. without:	0
Total no.:	30	No. of BBC's:	17

Method of usage

Electronic blackboard:	8	Small groups:	10
Individual use:	7	Administration:	0

Amount of usage and availability

Every day:	9	Varies:	2
All classes:	11	Selected classes:	0
Computer kept:			
Special room:	1	Kept in classrooms:	10
Locked away:			
When not in use:	2	After school hours:	6
School on one level:	3	More than one level:	5

Gender differences in use of computer

Girls approach different:	0	No difference:	7
Slight difference:	3		

Staffing

Teacher for Computing:	5	Intend to:	3	Do not intend to:	3

Opinions of staff

Computer important in schools?

Positive:	8	Negative:	2

Computer awareness should be part of curriculum?

Positive:	7	Negative:	2

Software

No. purchased independently: 20 or more: 5 10 or less: 5

No. written by staff or pupils: 10 or more: 2 5 or less:3 none:3

LEA provided only: 1

Note. The numbers relate to the number of schools.

Summary Table:QUESTIONNAIRE C3

Respondents: teachers from the Curriculum Award Middle Schools.

Number sent: 10

Number returned: 8

Note. The numbers relate to the number of schools.

Microcomputers in usage

No. of schools with:	7	No. without:	1
Total no.:	16	No. of BBC's:	13

Method of usage

Electronic blackboard:	2	Small groups:	6
Individual usage:	4	Administration:	0

Amount of usage and availability:

Every day:	5	When required:	1
All classes:	7		

Computer kept:

Special room:	1	Kept in classroom:	6

Locked away:

When not in use:	4	After school hours:	3
School on one level:	4	More than one level:	3

Gender differences in use of computer

Girls approach different: 2 No difference: 1 Slight: 4

Staffing

Teacher for computing:	6	Do not intend to:	1

Opinions of staff

Computer important in schools?

Positive:	7	Negative:	0

Computer awareness should be part of curriculum?

Positive:	4	Negative:	2

Software

No. purchased independently: 20 or more: 3 10 or less: 3

No. written by staff or pupils: 10 or more: 1

5 or less: 3 none: 2

LEA only: 1

Summary Table:QUESTIONNAIRE D1

Respondents: teachers from the preparatory schools in the Chiltern area.

Number sent: 10

Number returned: 4

Note. The numbers below relate to the number of schools.

Microcomputers in usage

No. of schools with:	4	No. without:	0
Total no.:	10	No. of BBC's:	6

Method of usage

Electronic blackboard:	1	Small groups:	4
Individual use:	2	Administration:	0

Amount of usage and availability

Twice weekly:	1	Very occasionally :	1
All classes:	3	Six years onwards only:	1
Computer kept in special room:	4	Kept in classrooms:	0
Locked away when not in use:	0	After school hours only:	3
School on one level:	0	More than one level:	4

Gender differences in use of computer

Girls approach different:	0	No difference:	1
Girl's school:	1		

Staffing

Teacher for Computing:	3	Intend to:	1	Do not intend to:	0

Opinions of staff

Computer important in schools?

Positive:	4	Negative:	0

Computer awareness should be part of curriculum?

Positive:	3	Negative:	0

Software

No. purchased independently:

20 or more:	0	10 or less:	3

No. written by staff or pupils:

10 or more:	0	5 or less:	1

Summary Table:Questionnaire D2

Respondents: teachers from preparatory schools in Cumbria.

Number sent: 5

Number returned: 2

Note. The numbers below relate to the number of schools.

Microcomputers in usage

No. of schools with:	2	No. without:	0
Total no.:	2	No. of BBC's:	2

Method of usage

Electronic blackboard:	1	Small groups:	2
Individual use:	2	Administration:	0

Specific usage: Teaching BASIC programming

Amount of usage and availability

Not regularly	1	Every day:	1
All classes:	2	Selected classes:	0
Computer kept in special room:	2	Kept in classrooms:	0
Locked away when not in use:	2	After school hours:	0
School on one level:	1	More than one level:	1

Gender differences in use of computer

Girls approach different:	2	No difference:	0
Slight difference:	0		

Staffing

Teacher for Computing:	0	Intend to:	1	Do not intend to:	1

Opinions of staff

Computer important in schools?

Positive:	2	Negative:	0

Computer awareness should be part of curriculum?

Positive:	2	Negative:	0

Software

No. purchased independently:		10 or less:	0
No. written by staff or pupils:	1		

Questionnaires:E,F.

MICROCOMPUTERS IN SCHOOLS

Please answer the following questions by either ticking the relevant answer or verbally as required.

1.Type of school:

Independent? County Upper? Other?

2.Do you have a microcomputer in your school:

YES? NO?

if yes continue with question 3 if no continue with question 25

3. Complete the following:

The microcomputer(s) is/are used for:

Teaching and/or Administration

Number: Make/Type:

4.Give details of peripheral equipment used.

5. Complete the following relating to Computer Science/Studies courses: GCE:'A'Level 'O'Level CSE

Board.

Prog.Language.

Av.Yearly No:Girls.

Boys.

6.Do pupils, other than those on the above courses, take any other type of computer courses YES? NO?

7.If the answer to question 6 was yes, complete the following:

Type of course? Class/year?

8. Give details of any other way the microcomputer is used in teaching?

9. Do you have a computer club: YES? NO?

10. If the answer to question 9 was yes specify the class/year(s) it is open to.

11.Do more boys than girls attend: YES? NO?

12.What proportion of the staff use the computer in teaching?

13.Do you,have a teacher responsible for computer studies:

YES? NO?

14. How many of the staff teach some form of computer studies?

15.What are their specialist subjects?

16. How is your school situated:

One level? More than one level?

17.Where do you mainly keep your microcomputer(s):

Special room? Each classroom as required?

18. Are they locked away:

(a) when not in use? (b) after school hours only?

19.Are all the pupils allowed to use the microcomputers:

YES? NO?

20. Do you have any educational software: YES? NO?

21. If the answer was yes to question 20 give details of:

(a) Software purchased:

NONE? ONE OR TWO? ABOUT TEN? ABOUT TWENTY? THIRTY OR MORE?

(b) Software written by the staff or pupils: NONE? ONE?

ABOUT FIVE? ABOUT TEN? MORE?

(c) Details of other sources?

(d) What are the most useful pieces of software used by the school?

22.If a mixed school has there been any noticeable differences between the approach of the girls when using the microcomputer and that of the boys: NOT MIXED? YES? SLIGHT? NO?

23. If the answer was yes to question 19, please extend.

24. What has been the greatest problem encountered in using the microcomputer in school so far?

25. What is the general opinion of the staff of the educational software available?

26. What is the general feeling of the staff towards the use of microcomputers in schools?

27.Do you consider it important that a school should have microcomputers: YES? NO?

28. Please expand your answer to question 27.

29.Do you consider that some form of computer appreciation/awareness should be part of the curriculum for your type of school?

30. Any other information would be appreciated. THANK YOU.

Summary Table:QUESTIONNAIRE E1

Respondents: teachers from the upper schools in the Chiltern area.

Number sent: 18

Number returned: 15(one uncompleted)

Note. The numbers below relate to the number of schools.

Microcomputers in usage

No. of schools with: 14 No. without: 0

Total no.: 227 No. of BBC's: 170

RML: 23 Sirius: 3 Spectrum: 8 Others: 4

Method of usage

Administration: 3

G.C.E.:"A" Level.

Girls: 7 Boys: 24

G.C.E."O"Level/C.S.E.

Girls: 229 Boys: 484

Languages taught:

Pascal: 4 Logo: 2 BASIC:remainder

Computer club. Yes: 11 No: 3

Amount of usage and availability

Special room: 13 Each classroom as required: 2

Locked away:

When not in use: 8 After school hours only: 5

All pupils allowed usage:

Yes: 7 No: 5

School situated:

One level: 1 Split site: 1 More than one level: 9

Gender differences in use of microcomputer

More boys than girls attending computer club: 10

Girls attitude different.

Yes: 7 No: 3 Slight: 4

Staffing

Number teaching computing: 37

Opinions of staff

Computer important in schools:

Positive: 14 Negative: 0

Computer Awareness as part of curriculum:

Positve: 13 Negative: 1

Software

No. purchased independently:

20 or more: 5 10 or less: 8

No. written by staff or pupils:

10 or more: 3 5 or less: 11 None: 1

Summary Table:Questionnaire E2

Respondents: teachers from upper schools in Cumbria.

Number sent: 16

Number returned: 13

Note. The numbers below relate to the number of schools.

Microcomputers in usage:

No. of schools with:	12	No. without:	1(on order)
Total no.:	136	No. of BBC's:	56
RML's:	21		
Method of usage.		Administration:	9
G.C.E.:"A" Level:		girls: 2	boys: 6
G.C.E."O"Level/C.S.E.:		girls: 148	boys: 212
Languages taught.		BASIC: 7	Various: 1
		LOGO: 1	
Details of other courses:		Comp. Apprec'n: 7	TVEI: 1

Gender differences in use of microcomputer

More boys than girls in computer club:	10	No:	1	
Girls attitude different:	7	No:	3	Slight: 2

Situation and availability of microcomputers:

Special room:	12	Each classroom as required:	2
Locked away:			
When not in use:	7	After school hours only:	6
All pupils allowed usage:	11	No:	2
School situated: one level:	2	more than one level:	11

Software

No. purchased independently:	over 20: 6	10 or less:	6
No. written by staff or pupils:	over 10: 6	5 or less:	5
	none: 2		

Number teaching computing: 32

Staff opinions:

On Computer Awareness as part of curriculum:

Positive: 12 Debatable: 1

On use of microcomputer in schools:

Positive: 13 Negative: 0

QUESTIONNAIRE F1:

Respondents: teachers from Independent schools in the Chiltern area.

Number sent: 7

Number returned: 5

Note. The numbers below relate to the number of schools.

Microcomputers in usage:

No. of schools with:	5	No. without:	0
Total no.:	41	No. of BBC's:	18
RML: 5 APPLE:	16	Others:	1

Method of usage.

Administration: 3

G.C.E.:"A" Level.

Girls:	10	Boys:	2

G.C.E."O"Level/C.S.E.

Girls:	48	Boys:	23

Languages taught: BASIC

Computer club: 3

Gender differences in use of microcomputer

More boys than girls attending computer club: 2

Girls attitude different: yes 2 slight 1

Situation and availability of microcomputers:

Special room:	4	Each classroom as required:	1
Locked away:			
When not in use:	3	After school hours only:	0
All pupils allowed usage:	3		
School situated: One level:	2	More than one level:	3

Software

No. purchased independently:

20 or more:	1	10 or less:	3

No. written by staff or pupils:

10 or more:	1	5 or less:	2	none:	1

Number of staff teaching computing: 7

Staff opinions:

On Computer Awareness as part of curriculum:

Positive: 4 Negative: 0

On use of microcomputer in schools:

Positive: 5 Negative: 0

Summary Table: Questionnaire F3

Respondents: teachers from the curriculum award independent schools.

Number sent: 3

Number returned: 1

Microcomputers in usage

Number with microcomputer: 1

Number of microcomputers in use:12

Number of BBC's:2 RML:10

Peripherals: 4 printers, Winchester disc.

Method of usage

Administration:1

Examinations: 'A' Nil

'O', Girls:5 :Language: BASIC

Other courses offered: YES:1

Type: Sixth year

Other uses of micros in teaching: not completed.

Computer club: Yes: 1 Open to: All: 1

School situated: One level:1

Microcomputer kept:

Special room: 1

Locked away: after school hours:1

All pupils allowed to use the computer: yes:1

Gender differences in use of computer

More boys attending than girls: yes, girls school.

Girl's approach different: girls school.

Staffing

Staff using the computer: few.

Teacher responsible for computer education:1

Number teaching computing: 2

Specialised subjects of those teachers: Mths/Physics.

Software

Purchased: twenty or more:1

Written by staff or pupils: about ten or more:1

Opinion

On importance of microcomputer in schools: not answered.

On computer awareness as part of the curriculum: positive: 1

APPENDIX D

Questionnaire:staff from a selected school 1984

D1

Questionnaire D: Selected school 1984.

Use of the Microcomputer

NOTE This survey relates to the use of computers in School and not to private/personal use.

1. Have you used the microcomputer in the last academic year? YES/NO

2. If NO:-

(a) Do you have any specific reasons for not having done so? If so, please state them.

(b) Please give some indication of what improvements or additional facilities you would require before considering its use in the future.

3. If you have used the microcomputer, please state year(s) and/or class(es) involved

4. What subject(s) and/or topic(s) were covered?

5. What software did you use?

6. Whether or not you have previously used a microcomputer in School, are you planning its use:-

(a) this term? YES/NO

(b) in Spring term 1985? YES/NO

(c) in Summer term 1985? YES/NO

7. Which year(s) and/or class(es) do you intend to use it with?

8. What subject(s) and/or topic(s) do you intend covering?

9. What software do you intend using?

10. (a) Have you found the microcomputer a useful aid? YES/NO

(b) Please give details of any particularly successful use, and also any instances of particular failure.

11. Have you experienced any difficulties or problems because of - e.g. - availability, reliability, software suitability, lack of expertise, transportation, etc? Please specify.

12. (a) How do you envisage the future use of the computer in this School?

(b) What ideas or suggestions do you have for its use within your own specialist area?

Thank you

ANY FURTHER REMARKS WOULD BE USEFUL:-

APPENDIX E

Software Index

E1

Software Index

1. Dart. Available from the Advisory Unit for Computer Based Education, Hatfield.
2. Quest. Available from the Advisory Unit for Computer Based Education, Hatfield.
3. Micronet 800. Database on Prestel.
4. MEP Primer Pack. Distributed to lower schools.
5. Moves. Department of Education. University of Southampton.
6. Mary Rose. Available from Ginn Microcomputer Software.
7. Expedition to Saqqara. Available from Ginn Microcomputer Software.
8. MEP Input Pack. Distributed to middle and upper schools.
9. Factfile. Available from Cambridge University press. Also distributed in the MEP Primer pack.
10. Animal: contained in the MEP Primer Pack.
11. Using Your Computer: Radio pack. Microelectronics in Education Programme:Introducing Science Extra. CET 1983.
12. Tree of Knowledge. Acornsoft Ltd.
13. Granny's Garden. 4MAT Educational Software.
14. Welcome Pack. Distributed with the BBC microcomputer.
15. Infoview. Available from the Advisory Unit for Computer Based Education.