

Chapter 3

Research Methodology

3.1 Introduction

This chapter describes the research methodology employed in the study, including the literature search and review, the data collection method, the data collection instrument, the research population and the method of sampling. The research methodology outlines and explains the relationship between the research problem, the literature review, the data collection method and instrument and the analysis of the research.

3.2 Literature search and review

The literature search is an important component of research in the social sciences. According to Aitchison (1998: 58), the literature search shows the researcher what has been done in relation to the problem being investigated. It ensures that no duplication occurs. It also brings about important understandings and insights necessary for the development of a logical framework (Gay 1976: 24).

Due to the largely exploratory nature of the study, an extensive search of international literature was conducted. The uniqueness of the research to South Africa required extensive literature on South Africa. Information acquired from the literature can be divided into the following categories:

- the relevance of ICT in education;
 - pedagogy, training and skills required for computer-based education;
 - school information and communication resources required for the utilization of ICT;
 - capacity in terms of the time and the skills of teachers to implement ICT projects;
 - lack of proficiency in the English language as a possible hindrance to the utilization of ICT in education in South Africa;
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- the role of multimedia as a possible solution to the use of ICT in education in South Africa;
 - short- and long-term challenges to the utilization of ICT in education in developing countries, including South Africa.³³

3.3 Research methods employed in the study

3.3.1 The survey method

The research purpose and objectives determine the type of research design employed for a

³³The first evaluative report of the WorLD programme considers many of the issues raised in this study. The report specifically considers skills required by students to reason with information, communicate ideas, collaborate with projects and use a variety of computer hardware and software tools (Kozma *et al.*, 1999: 1).

study (Katundu 1998: 58). Given the nature of the research problem and purpose of the present study, the most appropriate research methodology is the survey. According to Busha and Harter (1980: 62), survey research is capable of collecting background information and hard-to-find data and the researcher would not have the opportunity to motivate or influence respondents' responses. Sproull (1995: 30) recommends the survey technique for research where attitudes, ideas, comments and public opinion on a problem or issue are studied. The descriptive survey approach was chosen for the present study, because it seeks to gain insight into a phenomenon as a means of providing basic information in an area of study (Bless and Higson-Smith 1995: 42).

The strength of the survey method is also evident in its ability to study, describe, explore and analyse relationships among geographically scattered subjects, such as the WorLD schools included in this study. As a result, the researcher can apply the information gathered from a small sample to a large population. Though all WorLD schools in South Africa participated in this study, 20% of learners were sampled. From this sample, it may be possible to generalize the findings to the rest of Africa and other developing countries, which share characteristics with the areas of South Africa in which this study was conducted.

3.3.2 Evaluative study

At a broader level, this study can be described as evaluative research. The study seeks to assess what the current situation is in relation to what was intended – the plans, targets and objectives (Wyley 1996: 10). “In this evaluation the evaluator has become a mediator, a change agent, and the evaluation process is not viewed as judgmental ... but to assist make more informed decisions” (Guba and Lincoln 1989: 205). An evaluation such as this offers in-depth reflection at a point considered significant in the life of the project phase (Wyley 1996: 11) (in the case of the WorLD programme, the pilot phase from 1997-2000). The definition of evaluation, which guides and informs this study, is provided in van Rooyen (1996: 55):

“Evaluation is the process of identifying and collecting data about specific services or activities, establishing criteria by which their success can be assessed, and determining both quality of the service or activity and the

degree to which the service or activity accomplishes stated goals and objectives.”

Ruthman (1984: 162) states that evaluations are carried out to gain information for making decisions. This study is not specifically commissioned and can therefore be described as ritualistic; it should nevertheless provide worthwhile information for the WorLD programme and other similar projects in South Africa.

3.3.2.1 Types of evaluation approaches used in this study

Bawden (1990) mentions certain types of evaluation used in research. He distinguishes between macro-evaluation and micro-evaluation. Macro-evaluation evaluates how well, or otherwise, a system was performing, without attempting to say why it was working well or not. Micro-evaluation is diagnostic and examines in detail a system's performance, especially its failures, and makes recommendations for improvements (Bawden 1990: 15). The present study follows the micro-evaluation approach. Evaluation is also either external or internal. External evaluation, as is the case with the present study, is employed at a crucial period of a project, when there are supposed to be difficulties with the project.

A distinction is made between the attributes of quantitative and qualitative evaluation. Bawden (1990: 15) indicates that, whereas quantitative evaluation can be associated with experimentation and a high degree of control over the factors being studied, qualitative evaluation is associated with 'investigation', which is simply gathering data and suggesting ideas. As noted by Hounsel and Winn, in Bawden (1990: 31), a combination of both techniques, each compensating for the weakness of the other, is powerful. Qualitative research, on the other hand, emphasizes a holistic approach, treating the totality of the system under study and its context. A major benefit of the qualitative method is that it can allow the viewpoint of the user of a system to emerge and become a real factor in a realistic evaluation (Bawden 1990: 28).

3.4 Data collection method and technique

A self-administered questionnaire as a secondary data collection procedure was the main method used to collect data in the present study. Other methods used for the study include primary sources (documentation, online data), interviews, focus group discussions and

observations.

3.4.1 Data collection matrix

Table 3.1 Data collection matrix

Research questions	Research tools employed					Observation
	Documentation	Focus group discussion	Online data	Questionnaire	Interviews	
How successful was the training provided to teachers and students in WorLD schools?	✓	✓	✓	✓	✓	✓
What information resources exist in the schools, and do the schools have media teachers?	✓	✓		✓	✓	✓
To what extent are the WorLD teachers able to handle school projects, attend to computer systems and teach their normal school lessons?	✓	✓		✓	✓	✓
What is the literacy level of WorLD	✓	✓		✓	✓	✓

school pupils in terms of reading, accessing and using information in the English language?						
How far can multimedia fill the gap in the utilization of ICT in South African WorLD schools?	✓	✓		✓	✓	✓
What other factors contribute to the success or failure of the WorLD programme in South Africa?	✓	✓	✓	✓	✓	✓

Table 3.1 shows that all tools listed featured in the data collection strategy in relation to issues, with the exception of the online tool. Survey data was the main source of most of the data for the research. Interviews featured during the preliminary phase and were used to collect background information to establish the study. A focus group discussion with teachers was held and interviews during follow-ups to collect the research questionnaires.

Observations provided on-the-spot information during the initial phase of the study and during the questionnaire data collection stage. Another source of bulk data was printed material. The Internet also served as a useful source of current and unpublished data.

3.4.2 The self-administered questionnaire

A self-administered questionnaire was used, despite the sampled schools being scattered across three provinces in South Africa (Eastern Cape, North-West and KwaZulu-Natal). This was possible because:

- The researcher and WorLD teachers met at the South African National SchoolNet Computer Conference in 2000, dubbed the *Millennium Minds Conference 2000*.
- A pre-conference session, where the WorLD programme was discussed, provided the researcher with the opportunity of a focus group discussion of questions with WorLD teachers and thereafter administered the questionnaires.

A letter,³⁴ discussed with a consultant statistician, detailed the procedure for sampling of learner respondents by teachers at their various schools. This letter accompanied all questionnaires that were given out to teachers to administer questionnaires to learners.

³⁴The letter can be found in Appendix 5.

Two questionnaires were designed for data collection. The questionnaires were reformatted for coding and computer analysis (done by a computer and research consultant at the Department of Computer Studies at the University of Pretoria). Coding was important in the study, because it involved allocating computer columns to each question (De Vaus 1991: 233). A column for office use (for coding) was therefore created in both questionnaires.

One of the questionnaires was used for the teachers involved in the WorLD programme (Appendix 6). The other questionnaire was used for learners from participating WorLD schools (Appendix 7). Two questionnaires were used because the study sought to elicit views from both teachers' and learners' perspectives.

Questionnaires are one of the best impersonal observation techniques used for eliciting data (Leedy 1993: 187). Respondents are more likely to respond honestly because of anonymity. Questionnaires were used because it was not possible for the researcher to interview all 14 teachers and 20 per cent of the learners in each of the schools covered in the research population, which amounted to 91. A further reason for using self-administered questionnaires was that, since the schools are scattered across three provinces of South Africa, financial, logistical and time constraints would not allow for interviews to be used as the main data collection technique for this research.

The questionnaires were supplemented by telephone interviews and face-to-face interviews with teachers and SchoolNet SA officials who were part of the WorLD project team. This procedure gave clarity on issues, reducing the ambiguity that goes with questionnaires. In addition, the researcher's observation of the actual status of ICT in selected schools in KwaZulu-Natal helped with the design of the questionnaire. The researcher agrees with

Katundu (1998: 59), who said that the use of more than one data gathering instrument – the triangulation method – is considered vital in an under-researched problem such as that in the present study.

3.4.2.1 Format of questionnaire

The questionnaires used for this study are semi-structured, consisting of a mixture of closed and open-ended questions. De Vaus (1991) provides a number of advantages of closed or forced-choice questions. This is in spite of the problems associated with closed questions, such as providing an adequate range of alternatives to respondents. Another problem is that when a questionnaire is long (as in this study), motivation to answer could be low. De Vaus (1991: 86-87) states that closed question questionnaires are easier to code and recommends exhaustive alternative responses as a remedy to the problems. Open-ended questions were included in the questionnaires in the present study to determine the general feelings of teachers and students on issues and the reasons for their opinions.

The questions used in the questionnaires are fairly simple. The researcher therefore assumed that teachers and high school students would easily fill in the questionnaires. Considerable attention was given to developing simple, clear and unambiguous questions. The generic name *computer system*, for example, was used in the questionnaire instead of *information and communication technologies*. The researcher felt that not every student or teacher would know the term *information and communication technologies*, or the different types of computers and their names.

Questionnaires are designed to fulfil specific objectives (Leedy 1997: 192). The questionnaire for this study was designed to fulfil the objectives listed in Chapter 1 (section 1.5) of this thesis. The research questions, from which the sub-questions for the questionnaires were deduced, are also provided in Chapter 1 (section 1.6). An overview of the two questionnaires is provided, based on research objectives.

3.4.2.2 Overview of questions in the questionnaires

Questions in each of the questionnaires are categorized in sections. An overview of the sections and questions is presented.

Section A: Background information of school/project co-ordinator

Teachers/project co-ordinators' questions 1-14 and learners' questions 1-8 sought background information on the various teachers, schools and students.

Section B: Training and provision of skills for the WorLD programme

Teachers' questions 15-31 and students' questions 9-17 focused on training and the provision of skills to enable the use of ICT in the WorLD programme.

Section C: Teachers' background training

Teachers' questions 32-45 dealt with project teachers' background training. This covered pedagogical training and skills required for the implementation of ICT education.

Section D: Teachers' capacity issues

Teachers' questions 46-54 dealt with teachers' capacity (time and skills) to deal with computer problems in normal teaching settings and collaborative projects.

Section E: School resource situation for ICT education

Teachers' questions 55-68 dealt with the availability of school resources that support computer-based teaching and learning.

Section F: English language proficiency as a hindrance to the use of ICT in schools

Teachers' questions 69-74 and students' question 18-24 dealt with learners' English language proficiency.

Section G: Utilization of multimedia

Teachers' questions 75-80 and students' questions 25-27 explored the need for utilizing multimedia as an educational tool.

Section H: Benefits and challenges

Teachers' questions 81-86 and students' questions 28-30 explored the benefits and the challenges of the WorLD programme and factors that contribute to the success or failure of the programme in the schools.

3.4.3 Pre-test for validity and reliability

The questionnaires were pre-tested in two schools, which account for 10.5 per cent of the 19 schools sampled in the study. The purpose was to test the instruments for validity and reliability (Nevell 1993: 99) and to determine how realistic the questions were to the ability of learners and teachers. Nevell (1993: 112) stressed the importance of scrutinizing data-gathering instruments to identify ambiguity or misleading questions and for instructions and suggesting improvements. Minor changes were made after the pre-test, in collaboration with the supervisor of the study and other officials involved in the programme.

3.5 Research population

Leedy (1993: 197-198) observed that nothing comes out at the end of a long and involved study that is any better than the care, precision, consideration and the thought that goes into the basic planning of the research and the careful selection of the population. The research population of this study is defined as teachers/school project co-ordinators and students in schools that participated in the WorLD programme in South Africa. The names of 19 schools that participated in the programme are provided in Appendix 3. Table 3.2 lists the number WorLD schools according to province.

Table 3.2 Population of WorLD schools according to province

Province	Number of schools	Percentage of total
Eastern Cape	6	32
KwaZulu-Natal	7	36
North-West Province	6	32
Total	19	100

Table 3.2 shows the population of schools according to provinces that participated in the

present study.

The targets at the various schools were teachers, specifically WorLD programme co-ordinators, and students who participated in the WorLD programme. Nineteen teachers, representing 19 learning facilities, comprised the total population. Of the 19 learning facilities, one – a resource centre (the Zenzeleni Community Centre³⁵) – was not a school, but a WorLD computer centre.

According to a list of a number of learners provided by 14 teachers (see Table 3.3), 456 learners participated in the WorLD programme from the 14 schools. The mean number of learners was calculated and this amounted to 33 learners per school. The total number of learners from the 19 schools would therefore be $19 \times 33 = 627$.

3.5.1 Sampling

Sampling is a procedure of selecting a part of a population on which research can be conducted, which ensures that conclusions from the study can be generalized to the entire population.

Teachers in this study were not sampled because all 19 teachers, representing schools that participated in the WorLD programme participated in the study. Fourteen of the teachers were present at the Millennium Minds 2000 Conference at the Pretoria Boys' High School in September 2000. The remaining five of the total population of WorLD programme teachers were sent the questionnaires given to all teachers at the conference.

3.5.1.1 Stratified random sampling of learners

A stratified random sampling procedure was employed to determine the number of learners sampled for this study. According to Mulder (1993:58-59):

“To ensure that a sample will be representative of a population about which there is a fair amount of information available the population can be divided into sub-groups. One or more variables can be employed for this purpose for

³⁵ The Zenzeleni Community Centre (located in Mpophomeni) is one of the WorLD programme centres that serves the whole community instead of a single school.

instance... age, academic qualifications, and so on. The population of 5,500 can be divided into subgroups of ... One fifth of the number selected from the latter two groups can be selected from the first”.

A stratified random sampling was used for sampling learners, because learners were from different schools, with different total populations. They were thus divided into sub-groups, and 20% (which is one fifth) of each school was selected. Mulder (1993:59) indicated that “This selection from each sub-group is accompanied by either random or systematic sampling”. The present study adopted the random sampling procedure to choose the learners at the schools.

Teachers carried out the sampling of learners in a more systematic manner. A rigorous procedure was used to avoid a bias and maintain a representation of the diverse groups of learners in each school project. A simple random sampling procedure was adopted to select learners to answer the questionnaire. Steyn (1994: 16) state that, with a simple random sample, each element in the population that has not yet been included in the sample stands an equal chance of being selected in the next draw.

The sample size in each school was 20 per cent of the student population that took part in the WorLD programme. This number was determined by the researcher (with the help of teachers) and rounded off to the nearest whole number. The sample size was determined by the number of learners presented by each school (see Appendix 8). A strict simple random sampling procedure was discussed with teachers. The procedure was to be adhered to in the selection of learner respondents, as follows:

1. Teachers provide each learner in their class with a number from 01 – ON (N represents the number of the last learner) on the sampling day.
2. A row in a table of random numbers is selected at random.
3. Teachers chose the sampled numbers provided to students from the table, beginning with the first number selected at random. For example, if a teacher selects a random number of 91, he would select the first random learner 01.
4. The teacher goes through the list (row by row) and determines numbers that correspond

with any of the numbers of respondents in the class.

5. The process in step 3 is repeated until the number of selected respondents is completed.
6. The selected students fill in the questionnaire.

The simple random sampling procedure adopted in this study corresponds with the five steps of simple random sampling proposed by de Vaus (1991: 60):

7. Obtain a complete sampling frame.
8. Give each case a unique number, starting from 1.
9. Decide on the required sample.
10. Select the sampled numbers from a table of random numbers.
11. Select the cases, which correspond to the randomly chosen numbers.

Table 3.3 provides details of participating schools, study population and number of learners.

Table 3.3 Name of school, number of learners and sample range

	Name of school	Number of learners	Sample range
1	St. Joseph's Secondary	45	01-09
2	Estcourt Secondary	30	10-15
3	Nottingham Road Secondary	30	16-21
4	Asithuthuke Combined Secondary	40	22-29
5	Quakaza Senior Secondary	35	30-36
6	Mphophomeni High School	20	37-40
7	Ngwenyathi High School	40	41-48
8	Micha-Kgasi High School	15	49-51
9	Kgomotso High School	40	52-59
10	Gabonewe Secondary School	42	60-67
11	Leteane High School	33	68-74
12	Ngaka-Maseko High School	31	75-80
13	St Joseph's JSS	20	81-84
14	Nombulelo	35	85-91

Table 3.3 shows 14 schools that submitted initial data for the study. A mean number of 33 learners in each school took part in the WorLD programme, which works out as 627. The

total number of sampled learners therefore is 20% of 627, which is 125.

3.6 Data analysis

3.6.1 Data presentation and analysis

Descriptive statistics were adopted for presenting and analysing the data in this thesis; the researcher can summarize patterns in the responses from the sample by the use of frequency tables, percentages and charts (De Vaus 1991: 135-137). However, inferential statistics was used, where necessary, to determine if the patterns described in the sample can be applied to the population from which the sample is drawn.

A computer program, developed and provided by the University of Pretoria's Department of Computer Sciences, established the frequency distribution. The frequency distribution was examined by looking at the issues that were represented by the respondents and what the most typical responses were.

3.6.2 Coding of data

3.6.2.1 Coding of closed questions

There was a need to allocate a code to the answers of each question or variable.³⁶ De Vaus (1991: 233) said that the essence of coding is to give a distinctive number to each answer in a question. The number is fed into the computer. A pre-coding procedure was adopted for computer data analysis. This is because most of the questions (over 85%) were closed questions, with predetermined answers to each question. It was therefore necessary to allocate codes to the answers.

3.6.2.2 Coding of open questions

According to De Vaus (1991: 239), open-ended questions often produce multiple responses that require the creation of several variables to capture the responses. It is therefore best to construct a number of variables into which responses can be sorted and coded. A multiple

³⁶ A detailed coding process is provided in Appendix 8 of this study.

response approach was used for coding the open-ended questions in this study. A post-coding procedure was used. Categories were created from the responses received to a particular question. A code was allocated to a particular category, for respondents' answers.

3.7 Summary

This chapter described the research methodology employed in the study. The research method employed is reviewed and details of the evaluative research procedure are provided. The data collection method and tool are discussed, and the research questionnaires and how they were administered are described. The study population provided details of the range and location of individuals covered in the study, while the sampling procedure detailed the method adopted in limiting the range to specific individuals. The data analysis involved the use of a coding method.

Chapter 4

Data presentation and analysis

4.1 Introduction

Chapter 4 presents the survey data and analysis based on the objectives set for the study and the research questions which were outlined in Chapter 1. Findings from two questionnaires project coordinators/teachers and learners are outlined. Tables, figures and descriptions of data are used to present the findings.

4.2 Background data

The data that follows in section 4.2 provides a context in which the study was conducted. Questions and source of data is summarised in Table 4.1

Table 4.1 Data analysis of background on WorLD school co-ordinators and students

Question	Source and location of Data
How many schools participated in the project?	1. Interview with National WorLD project co-ordinator 2. Sampled number of schools 3. SchoolNetSA website http://www.school.za

What was the response to administered questionnaires?	Responses of questionnaire received. Figure 4.1
What was the gender representation of co-ordinators?	Teachers' question 1
What was the racial composition of co-ordinators?	Teachers' question 2
What was the motivation of co-ordinators?	Teachers' question 3
What was co-ordinators' background use of computers?	Teachers' question 4
Are you a black/white south African?	Students' question 2
In what grade are you?	Students' question 3; Table 4.2
Have you ever been trained to use a computer?	Students' question 4
Have you used a computer before the project?	Students' question 5
Do you have a computer at home?	Students' question 6
Does the computer you have at home function?	Students' question 8

4.2.1 Background information of project co-ordinator

According to information acquired from National WorLD project co-ordinator and literature 19 schools in three provinces participated in the WorLD programme in South Africa. All 19 schools which formed the research population participated in the study. Eight schools, represented by WorLD teachers, responded to the questionnaire. A 42 % response rate was thus achieved. One hundred and twenty-five learners, sampled from a total of 627, represented 20 % of WorLD learners. A single learner could have been sampled from each school to gauge learners' experiences. This was extended to 20% to expand the experience of learners from the project. A total of 45 learners (36%) responded to the questionnaire. A small response sample size limited generalisability therefore grounding findings in the extensive literature survey of study.

Figure 4.1 Provincial response rate of WorLD schools in South Africa

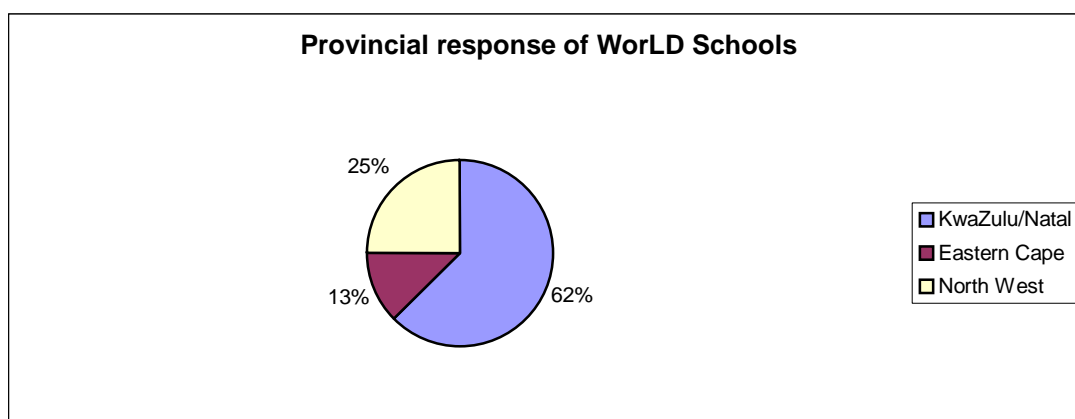


Figure 4.1 shows that the majority (five (62%) of the eight teacher respondents are from the KwaZulu-Natal province. Two (25%) are from the North-West Province.

Four (50%) teacher respondents are female and the rest are male. An equal gender participation in the programme bodes well for teacher ICT education in South Africa.

The majority of teacher respondents (five (64%), are black South Africans. White, Indian South Africans and a black non-South African teacher also participated in the programme. Half of the teacher respondents were self-motivated participants in the project, while others were either nominated or appointed after an interview process. The high number of self-motivated teachers is an indication of teachers' interest in ICT education. Despite the enthusiasm, a large number of them (five (62%), had never used a computer before the introduction of the WorLD programme to their schools.

4.2.2 Students' background data

A total of 45 learners participated in the study as respondents. Fifty-six per cent of learner respondents were male and 45 per cent female. A majority of (43 96%) were South African black students; one was a non-South African black and one a white non-South African. It is noted again that the WorLD programme targeted previously disadvantaged black schools.

Table 4. 2 Grades of respondent learners N=45

Grade	Number of students	Percentage
8	4	9
9	11	24
10	13	29
11	10	22
12	7	16
Total	45	100

Table 4.2 shows that most of the learner respondents that participated in the WorLD programme were in Grade 10 i.e. (13(29%); the lowest number of learners, (4(9%) were in

Grade 8.

Twenty-eight learners (62%) had never used a computer before the introduction of the WorLD programme to their school. Regarding training, (35 (77%) learners had not been trained to use computers before the programme. Thirty-nine (89%) learners do not have a computer at home. All respondents with computers at home said the computers were functional. Eighty per cent of learners' computers at home are not connected to the Internet.

4.3 Data covering research questions

Sections 4.3.1 to 4.3.9, provides data and analysis of the main research questions covered by this study. A table in each section provides the main research questions and data relating to specific questions relating to the issue under study.

4.3.1 Training for the WorLD project.

Table 4.3 provides the main research question, sub-questions, tables and figures that provide data relating to the questions.

Table 4.3 Training provided during the WorLD project

Question	Data
1. How successful was the training provided to teachers and learners during the WorLD programme in South Africa?	Sect. 4.3.1
Which application software have teachers been trained in?	Table 4.4; Figure. 4.2
Which technical skills were provided to WorLD teachers?	Table 4.5; Figure 4.3
Which pedagogical methods are teachers familiar with, trained in and use?	Figure 4.4
What number of days and hours were teachers trained?	Figure. 4.5
What information related training have you and other teachers had?	Figure 4.6
What other teachers on staff had access to technical ICT training?	Table 4.6
How have you been trained for the WorLD programme?	Figure 4.7
If you have been trained, how many hours per day were you	Table 4.7

trained?	
How many days in total were you trained?	Table 4.8
Which of the listed application software have you been trained in?	Figure 4.8
Which of the following training did you find to be unsatisfactory?	Table 4.9
Which of the following systems have you been trained in?	Figure 4.9
Which operating system were you as a learner trained in?	Table 4.10
To what extent have you had a computer to practise after training?	Table 4.11
To what extent have you been trained for collaborative school projects?	Table 4.12

4.3.1.1 Training of teachers for the WorLD programme

This section provides data that determines the extent to which teachers were trained for the WorLD programme. The areas of training explored are:

- Computer literacy
- Technical computer skills
- Pedagogical methods and
- Collaborative training

1. Computer literacy training

This section addresses the extent of computer literacy provided to teachers to enable them to train learners and to use computers for the WorLD project. It outlines the skills required and teachers' responses to the skills provided.

The question was asked whether or not teachers were trained at all and which application systems they were trained in. All respondents indicated that they were trained in one or more computer application programs for the WorLD project. Table 4.4 and Figure 4.2 represent the computer application skills in which teachers were trained. Table 4.4 provides absolute numbers of teachers trained per application program and percentages. Table 4.2 and Figure

4.2 show that many respondents received training in many of the listed applications. All respondents were trained in word processing, spreadsheets and Web design skills. There was, however, no training in databases and programming.

Table 4.4 Applications in which WorLD teachers were trained N=8

Application software	Type/product	Absolute number trained	Percentage trained
Word processing	Microsoft Word	8	100
Spreadsheets	Microsoft Excel	8	100
Presentation graphics	Power Point	6	75
The Internet	Internet Explorer	4	50
The Internet	Netscape	3	38
Electronic mail	GroupWise	6	75
Electronic mail	Pegasus	4	50
Database	Microsoft Access	0	0
Web design		8	100
Information skills		4	50
Programming		0	0

Figure 4.2 Applications in which WorLD teachers were trained

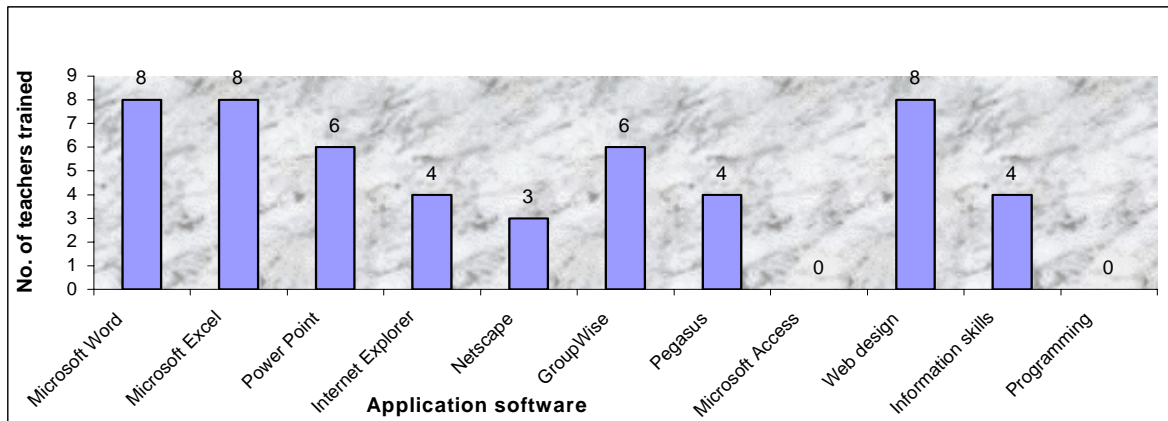


Table 4.4 and figure 4.2 provide data showing the number of WorLD teachers and application software in which they were trained.

2. Technical computer skills

Training in technical computer skills was a critical component of the WorLD programme. The question asked was which technical skills were provided to WorLD teachers to enable them to maintain computer systems during the project. The three main areas of computer systems explored were hardware, software and networking.

Table 4.2 and Figure 4.3 provide an overview of the technical skill which WorLD teachers were trained in during the project. Table 4.2 shows the three main components of the technical training of WorLD teachers. It details the type of training and the particular product that the teachers were trained in, the absolute number of teachers trained and the percentages.

As observed in Figure 4.3, the majority, (seven (88%)), of the teachers were trained to physically identify computer components and their functions. Only one teacher was trained in the use of Windows 2000 and none in the UNIX operating system.

Table 4.5 Computer systems in which WorLD teachers were trained N=8

Computer system	Type/product	Absolute number trained	Percentage trained
Hardware	Physical identification of computer components and their function in a computer system	7	88

Operating system software	MS DOS	2	25
	Windows 95	5	63
	Windows 98	5	63
	Windows 2000	1	12
	Windows NT	2	25
	Unix	0	0
Networking	Networking systems and procedures	2	25

Figure 4.3 Computer systems in which WorLD teachers were trained

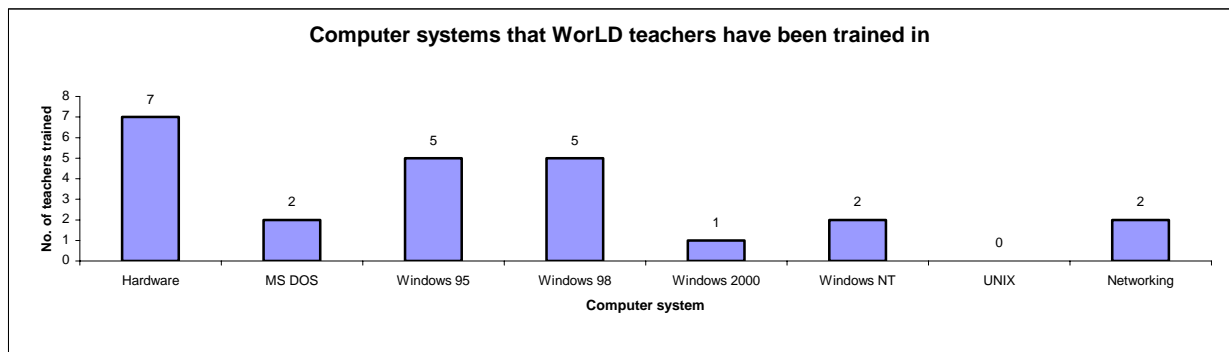


Table 4.5 and Figure 4.3 show number of teachers and the computer systems in which they were trained.

3. *Pedagogical skills*

As the WorLD programme sought to integrate computers into the teaching and learning process in project schools it was required not only to train teachers in the skills of using computers, but for teachers to integrate the computers into the teaching and learning process and to be able to use the computer to teach subjects such as language, mathematics and science. To this end a number of questions were asked which related to the project teachers' professional knowledge and use of teaching methods. The questions addressed pedagogical areas such as:

- project-based learning
- the constructivist learning method
- resource-based learning method
- authentic learning method
- research-based learning
- student team method and
- the systematized learning method

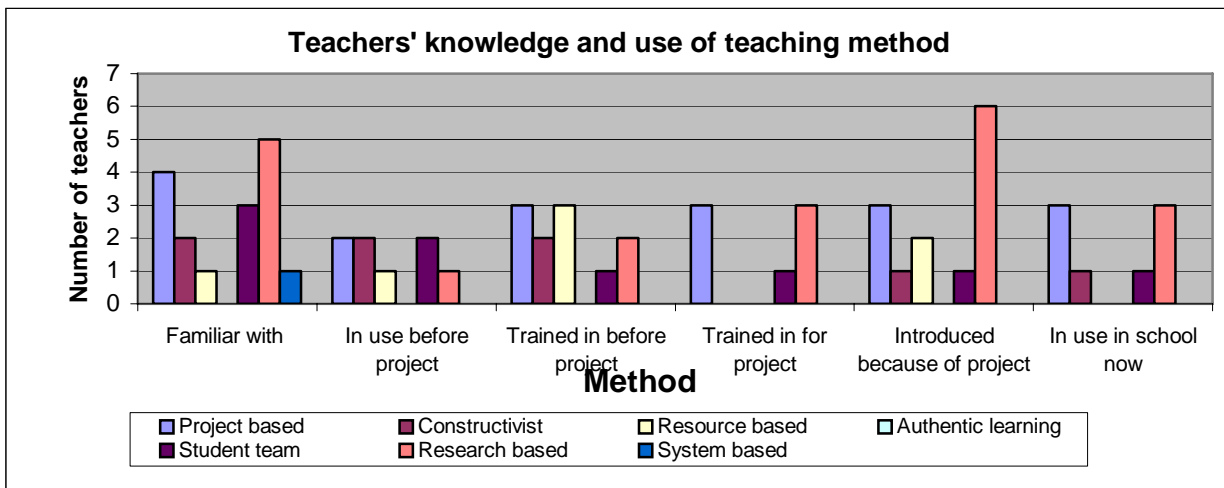
Figure 4.4 shows that (five (62%) respondents are familiar with the research-based teaching method. Fewer than half of the teachers were trained in each of the methods and were trained in only three teaching methods for the WorLD programme. While only one teacher has knowledge of what the system-based method is, no teacher is familiar with, or has been exposed to, any training regarding the authentic learning method. Two teachers use the constructivist and the student team methods in their schools now. One school in each case uses the resource and research-based methods. No school utilizes the authentic and system-based methods of teaching.

Perhaps respondents' professional training accounted for the limited familiarity, exposure, or use of the listed teaching methods. Half of the respondents have only a Higher Diploma in Education. One respondent has a Bachelor's degree in Education; two have Honours degrees and one has a Masters degree. Regarding the introduction of new teaching methods to the school, three of six respondents indicated that the WorLD trainer introduced the new teaching method, while the other three said they, the teachers, had introduced the method into their school. An interesting observation in Figure 4.4 is that the new method (resourced-based) introduced to the schools because of the WorLD project had been abandoned and was no longer in use. Another interesting observation is that the constructivist method which has been in use by two schools before the WorLD project was now being used only in one school.

As to whether teachers were pursuing further studies regarding these methods, (three (37%) were undergoing training to upgrade and equip themselves for technology-based professional

education. Two of those pursuing further training indicated that they were receiving training at a university and the other was receiving training at a college. Three (37%) respondents who were not undergoing further studies indicated that finance was their constraining factor, while the remaining two were pursuing other interests outside teaching.

Figure 4.4 Project teachers' training, knowledge and use of teaching methods



4. Collaborative training

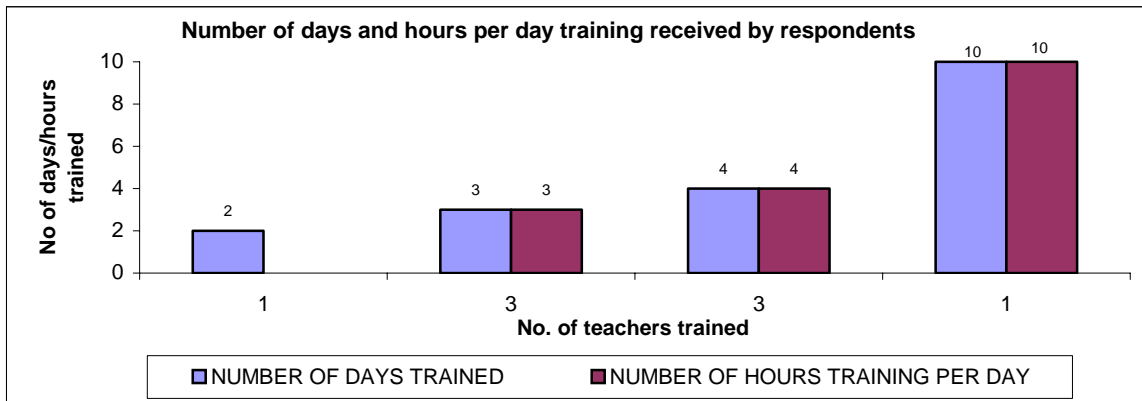
Collaborative training for teachers was crucial to enable them to train WorLD learners to undertake online education projects with their peers all over the world. The question asked was whether or not teachers had been trained in collaborative skills.

Six (75%) teachers received training in online collaborative school projects. Five (62%) of these teachers do not use information from the Internet for teaching purposes, although they have all been involved in at least one collaborative project. To the question why they do not use information from the Internet, three (50%) of the six respondents said the Internet was often not available. As to why not many collaborative projects have been undertaken, half of the six respondents indicated that the Internet was often not available; the other half said there was often no time for collaborative projects.

The number of days and hours for which teachers were trained could have a negative impact

on the skill level acquired. Figure 4.5 shows that training varied in duration from one to ten days and from three to ten hours per day. The majority of teachers, six (75%), were trained for between two and five hours per day, for six days. Only one teacher was trained for up to ten days.

Figure 4.5 Number of days and hours in which respondent teachers were trained



It is gratifying to know that all respondent teachers had computers with which to practise after training sessions.

The majority, (six (75%)), were unable to provide technical support for their schools' computer system due to a lack of the required technical skills. This might be due to the limited number of days of training acquired. The aspect of training found to be most satisfactory, according to 83% of the respondents, was word processing. The aspect found to be most unsatisfactory was technical training. Perhaps the inadequacy of technical training led to an 88 % response recommending it as the area that required further training.

Teachers generally had embarked on technology related training themselves, in one form or another, to keep abreast of the skills necessary to be able to use ICT tools to teach.

Figure 4.6 reveals that many teachers – those that were part of the WorLD programme and

those that were not – have received other educational ICT training. Non-WorLD teachers have had no access to one-to-one professional mentoring and the training offered by the Department of Education. Data was also provided regarding efforts made by other teachers to provide themselves with ICT related skills. Table 4.6 shows that, in a particular school, as many as ten teachers were trained in technical ICT-related skills. In seven of the eight respondents’ schools, other teachers on the staff had access to technology-related training.

Figure 4.6 Information technology-related training that WorLD and other teachers

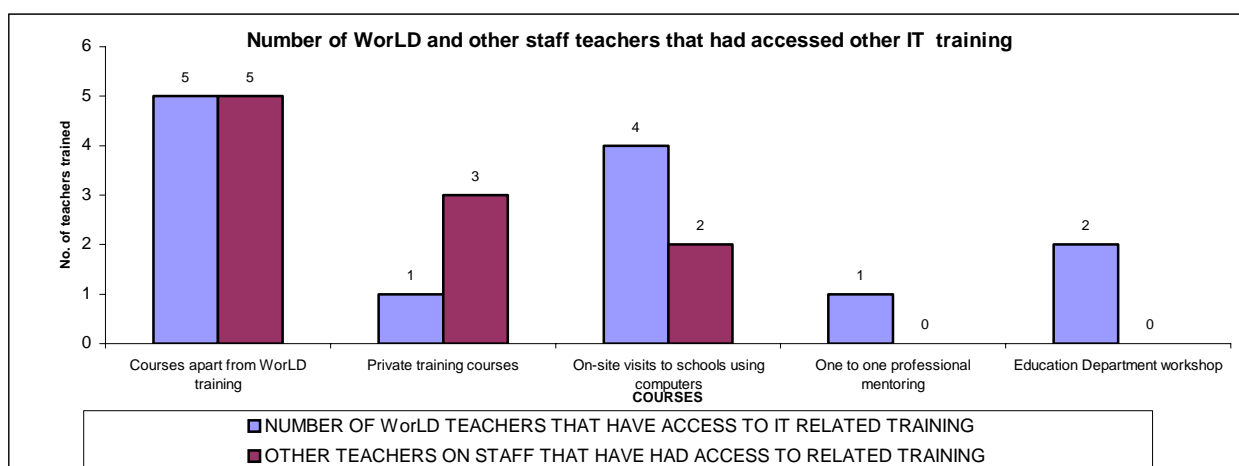


Table 4.6 Other teachers on staff who had access to technical ICT training N=7

Course	Number of school	Number of Teachers accessing training themselves
Technical ICT training	1	2
	1	3
	4	4
	1	10

Table 4.6 shows number of schools and number of teachers excluding WorLD coordinators that are making efforts to provide themselves with technical skills.

4.3.1.2 Training of learners for the WorLD programme

Training of WorLD school learners comprised a major component of the programme and hence one of the objectives of the project. The study therefore investigated the manner in which the training was provided to the learners. Learners were asked about the type of training and manner in which the training was conducted.

On the whole, respondent learners did not receive satisfactory training during the project. Regarding the manner of training received, Figure 4.7 shows that 18 (40%) of the respondents indicated that they were not trained well during the project. Sadly, 16 (36%) were not trained at all. It is evident that there was no consistency in the training time provided. For example, Table 4.7 shows that, while seven learners (23%) were trained for less than one hour a day, five other learners (17%) were trained for more than five hours per day. The data have shown that there was no consistency in the number of days for which learners were trained. Table 4.8 shows that although the majority, 18 (60%), of the learners were trained for more than a total five days; four (13%) were trained for only two days.

Learners had been trained in many of the application systems listed (Figure 4.8). There was, however, no training in database, information skills and programming. Figure 4.9 shows that it was only in Windows 95 that some training was provided for more than half of the respondents. There was no training in Windows 2000, Windows NT and the UNIX operating systems.

Regarding satisfaction with training received, Table 4.9 shows that 11 (25%) learners were least satisfied with the training in Microsoft Excel and Pegasus Mail. They were most satisfied with training related to GroupWise and Microsoft PowerPoint. Training in computer systems generally was unsatisfactory. As observed in Table 4.10, all trainees in networking found it to be unsatisfactory. Two-thirds of learners who took part in the hardware training, as well as 80% who took part in the Windows 95 training, found them to be unsatisfactory.

Access to training equipment to practise was no better. From Table 4.11 it can be seen that only two learners (7%) always had access to computers to practise after training. Eleven learners (36%) had no access to computers after training. Finally, some credit has to be given for collaborative training. Table 4.12 shows that 72% were trained well. Seven learners (22%) were not trained in collaborative projects at all.

Figure 4.7 Manner of training WorLD learners

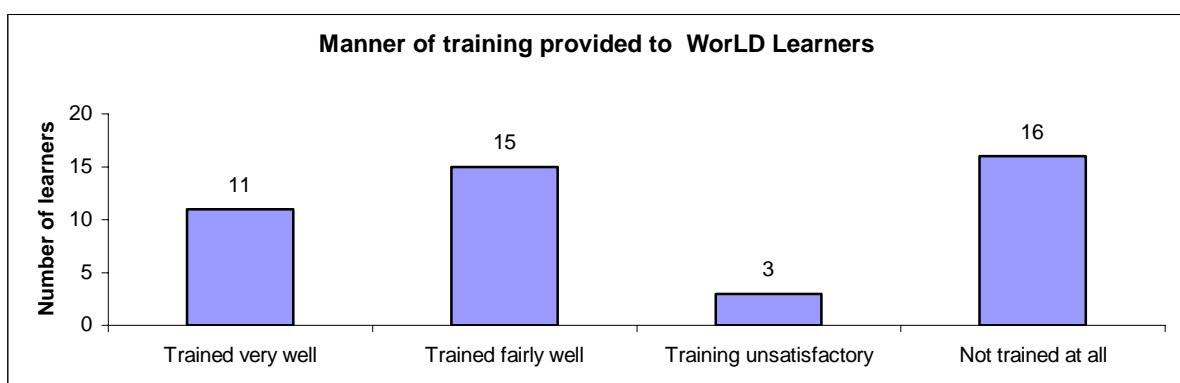


Table 4.7 Hours trained per day N=30

Hours per day	Number response	Percentage response
Less than 1 hour	7	23
2 hours	9	30
3 hours	5	17
4 hours	4	13
More than 5 hours	5	17

Table 4.8 Number of days trained N = 30

Number of days trained	Number response	Percentage response
2	4	13
3	6	20
4	2	7
≥5	18	60

Figure 4.7, Tables 4.7 and 4.8 provide data on manner and duration of training provided to learners during the WorLD project.

Figure 4.8 Applications in which WorLD learners were trained

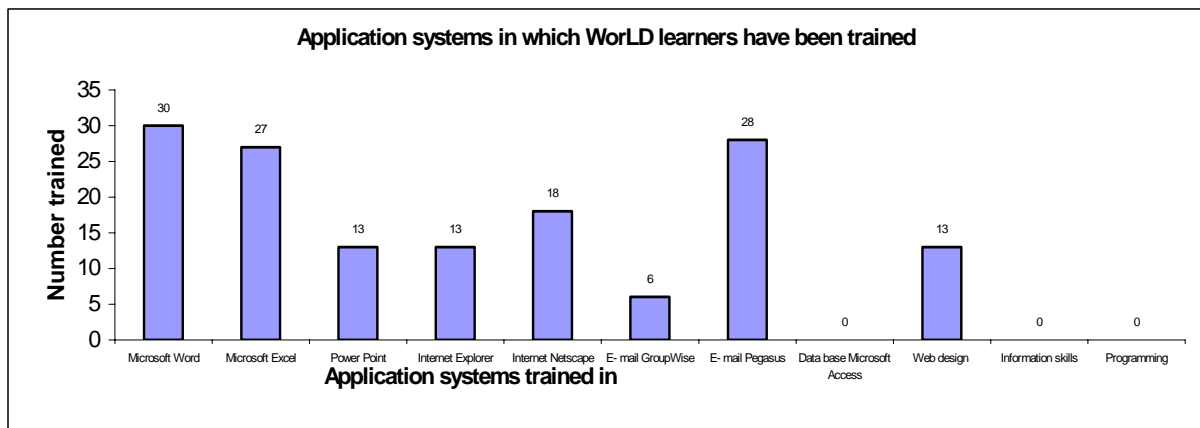


Table 4.9 Satisfaction with training in computer applications N=44

Application software	Absolute response	Percentage response
Microsoft Word	3	7
Microsoft Excel	11	25
Microsoft PowerPoint	1	2
Internet Explorer	8	18
Netscape	3	7
GroupWise	1	2
Pegasus	11	25
Web design	6	14

Figure 4.8 outlines data on the Application systems in which WorLD teachers have been trained in and Table 4.9 provides data on the satisfaction derived from the training.

Figure 4.9 Computer systems in which WorLD learners were trained

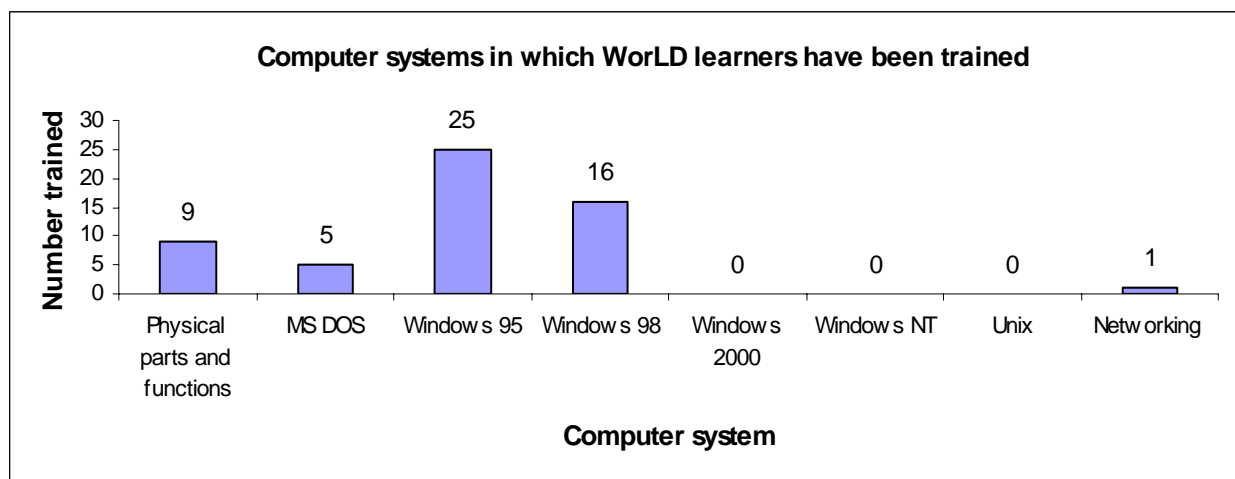


Table 4.10 Operating systems learners were trained in. Percentage not satisfied N=30

System	Response	Percentage not satisfied with training
Hardware	8	89
MS DOS	4	80
Windows 95	14	56
Windows 98	15	94
Windows 2000	0	0
Windows NT	0	0
Networking	1	100

Figure 4.9 and Table 4.10 provide data on operating systems learners have been trained in and the level of satisfaction of each of the systems trained in.

Table 4.11 Access to computer to practise after training N=30

Access to computer for practice	Response	Percentage
Always had access	2	7
Sometimes had access	12	40
Seldom had access	6	20
Never had access	11	36

Table 4.12 Manner of training for collaborative school projects N=31

How learner was trained	Response	Percentage
Trained very well	13	41
Trained fairly well	10	31
Unsatisfactory training	2	6
No training	7	22

Tables 4.11 and 4.12 provide data on access to computers by learners to practice skills learnt and manner in which collaborative training took place.

Table 4.13 provides questions and location of data relating to resources in WorLD schools

Table 4.13 WorLD information resource situation questions and data

Question	Data
2. What information resources (Computer laboratories, Internet, libraries, multimedia centres) exists in the schools and do the schools have media teachers?	Sect. 4.3.2
Which of the resources listed existed in your school before the introduction of the project?	Figure 4.10
Which of the listed information resources exists in your school	Figure 4.11

now?	
How many computers are not in working condition in your school?	Table 4.14
How many computers do you have in working condition in your school?	Table 4.15
How many of the school computers have CD-ROM drive?	Table 4.16
Which of the following technology existed in your school for the purposes of teaching?	Figure 4.12
Which of the following technology existed in your school for the purpose of teaching before the WorLD programme?	Figure 4.13
What forms of support did your school receive during the WorLD project?	Table 4.17
What computer operating systems did you have in WorLD schools?	Table 4.18

4.3.2 WorLD school resource situation

All human activities require the provision of appropriate resources to bring about their implementation. This study investigated the provision of the requisite resources that would allow the implementation of the WorLD programme in schools in South Africa. The questions posed among others were: what was the state of resources in WorLD schools before and during the project?

There was very limited provision of the requisite resources that support ICT education in WorLD schools before the implementation of the project in WorLD schools. Figure 4.10 shows that three schools (38%) had a library or media centre, (two (25%) had a computer laboratory and one (13%) had a dedicated library media teacher. There was no multimedia centre, Internet access or Network controller.

The implementation of the WorLD programme saw improvements in the resource situation. Figure 4.11 shows that the majority, seven (88%), of the sampled schools had computer laboratories. Three sampled schools (21%) had libraries and (two (14%) had media teachers and regular Internet access. There was no multimedia centre and no Network controller in any of the sampled WorLD schools.

Figure 4.10 Resources at schools before WorLD programme was introduced

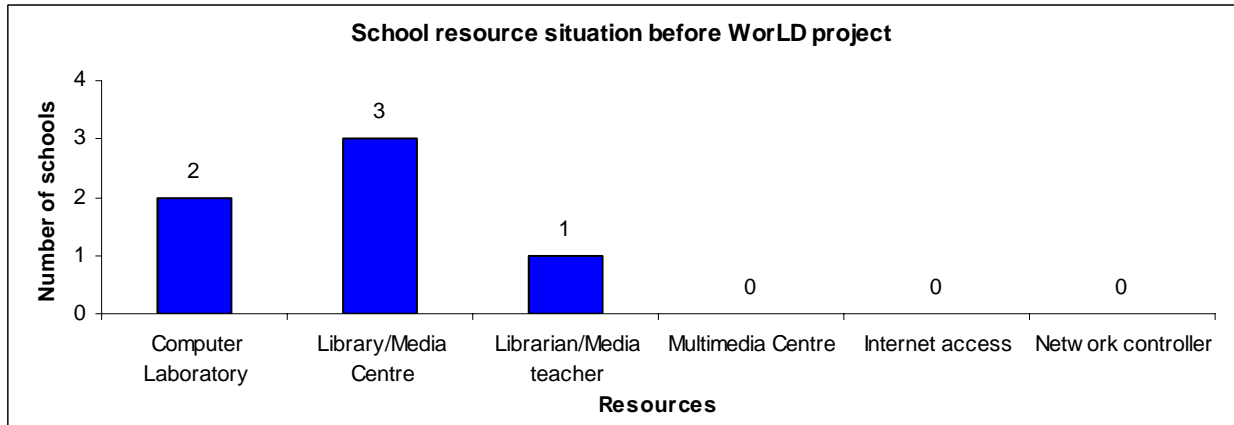
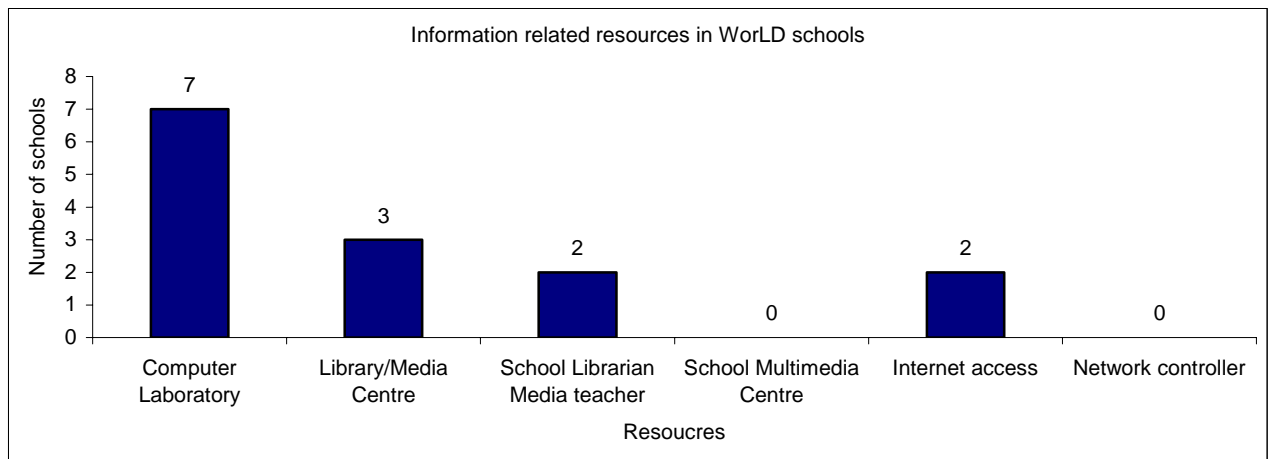


Figure 4.11 Information resources existing in WorLD schools during the programme



Figures 4.10 and 4.11 details WorLD school information resource situation before and during the WorLD programme in schools.

Figure 4.11 shows that three schools with Library/Media centres constituted the highest number of information resources before the WorLD project was introduced. There was no school with working computers, computer systems or peripherals.

Critical resources, without which the WorLD programme could not take place, were

computers. Schools were therefore asked what type of computers they had. In this regard the issue that was investigated was solely the computer hardware resources.

Table 4.15 shows that 108 working computers, in total, were available in WorLD schools, which is an average of 13.5 computers per school. Only three schools had Pentium computers. What was interesting was that one school had as many as 21 Pentium computers.

Not all computers were in working condition. Table 4.16 shows that 16 computers (a mean average of two computers per school) were not functional during the WorLD programme.

This means that schools had, on average, only (11.5 (12) working computers.

Concerning computer peripherals, only a limited number had CD ROMs. It is observed, however, in Table 4.16 that all computers with CD-ROMs in the sampled schools were in working condition at the time of taking the sample. The Table also shows that, while an average of five computers per school have CD-ROMs; one particular school has 21 Pentium computers with CD-ROMs. This indicates skewed access to computers with CD-ROM drives.

Table 4.14 Computers not in working condition at WorLD schools N=8

Type of computer	Number available and not in use	Number of schools
286	3	1
486	2	1
	3	1
	4	1
Pentium	4	1
Total	16	5

Table 4.15 Computers in working condition at WorLD schools N=8

Type of computer	Number available and in	Number of schools
------------------	-------------------------	-------------------

	use	
286	3	1
486	4	1
	6	1
	8	2
	11	1
	14	1
	22	1
Pentium	5	1
	6	1
	21	1
Total	108	11

Tables 4.14 and 4.15 provide comparative data between computers in working condition and those not.

Table 4.16 Computers with CD-ROM N=8

Type of computer	Number working with CD-ROM	Number of schools
286	0	8
486	1	1
	2	3
	3	1
Pentium	3	1
	5	1
	21	1
Total	39	16

4.3.2.1 Other technology present and used in WorLD schools

The study investigated whether or not there was other technology present at WorLD schools during the project. It is supposed that the presence of other technology would influence the general use of technology for education in schools. Teachers were asked which technology existed in their schools during the project.

Available data shows that technological equipment was being used in WorLD schools.

Televisions and video machines top the list of school equipment. Data projectors and slide

projectors are not used in any of the sampled schools (Figure 4.11). As seen in Figure 4.12, much of this equipment had existed in the WorLD schools before the project. It is interesting to observe in Figures 4.12 and 4.13 that during the project the amount of equipment had increased, except for radios, which had decreased by one. Available data shows that (six, (75%) of the sampled schools received support from better-resourced schools within their proximity. The forms of support received are presented in Table 4.17.

Figure 4.12 Other technology used for teaching in WorLD schools

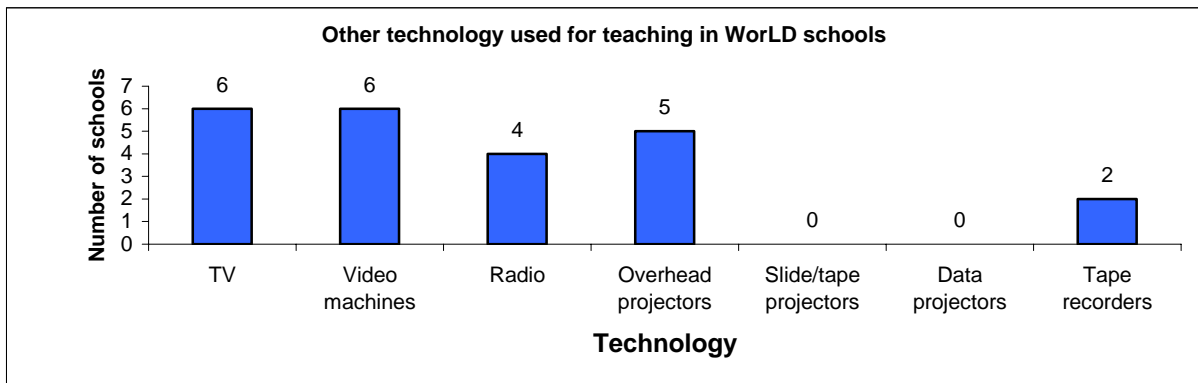
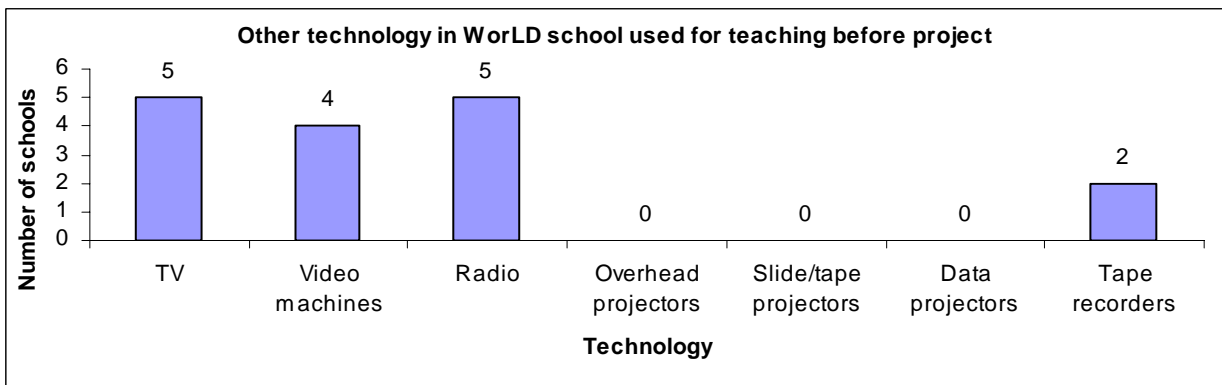


Figure 4.13 Other technology used before WorLD programme



Figures 4.12 and 4.13 compare other technology used for teaching in schools before and during the WorLD project in Schools in South Africa.

Table 4.17 Forms of support received by WorLD schools

Form of support	Number of schools receiving support
Donation of old computers	2
Donation of new computers	2
Technical	3
Mail/network services	1
Other (software)	1

Technical support was the main form of support received from better-resourced schools, as shown in Table 4.17. A respondent school indicated that it did not seek such support. Another said schools that could offer such support were far away.

4.3.2.2 Computer operating systems in WorLD schools

Computers without operating systems that make them functional are empty boxes. The study investigated which of the two categories were present in the WorLD schools. The type of operating system had many implications for the project in the school. Teachers were asked which computer systems were available in the computers in their schools. The responses (Table 4.18) show that many computers use a variety of operating systems, which include DOS, UNIX, Windows 95 and Windows 98. Windows 3.1, Windows 2000 and Windows NT are not in use in any of the schools.

The majority, seven (88%) of the sampled WorLD schools had computer networks. Four had file servers. Six (75%) schools use dial-up modems and three (60%) out of five schools had only one computer connected to the Internet.

Table 4.18 Computer operating systems in WorLD schools N=8

Type of operating system	Number of computers with system	Number of schools with system
DOS	26	3
	27	1
UNIX	26	3
Windows 3.1	0	0
Windows 95	11	3
	20	2

Windows98	12	4
	27	3
Windows 2000	0	0
Windows NT	0	0

Table 4.18 lists computer operating systems in WorLD schools while Table 4.19 provides questions relating to Teachers' capacity and data location.

Table 4.19 Teachers' capacity situation providing questions asked and data

Question	Data
3 To what extent are computer teachers able to handle school computer projects, attend to computer systems and attend to their normal school lessons?	Sect. 4.3.3
Which of the following attributes have you acquired to manage your school computer system?	Table 4.20
If you have acquired any of the attributes how do you rate it?	Table 4.21
To what extent does your project duty affect your normal teaching?	Table 4.22
Which of these supports have you received from the project?	Figure 4.14
How supportive has your school and principal been?	Figure 4.15
Reasons for lack of support from school principals	Table 4.23

4.3.3 Capacity issues

The WorLD project was a new project in schools in which it was undertaken and it was a novelty for administrators, educators and learners. Project teachers did not carefully consider the workload they had before the project so as to make adjustments and prepare for their new roles of manning computer networks, training learners and undertaking collaborative projects. This section provides data on the extent to which teachers had acquired skills they were trained in, and on other capacity issues, that affected their new role as WorLD project co-ordinators. The issues considered were ability, time and confidence to deliver on WorLD projects in schools. Teachers were asked which of the listed attributes, namely ability, time

and confidence, they had acquired to manage their school computer system.

Teachers, generally, had acquired the ability to deliver first level support and maintenance of their school computer system. Table 4.20 testifies to the fact that almost two-thirds of the respondents (63%) had acquired the necessary skill to support and maintain computer systems. The Table shows, however, that there was no time to implement the skills in their schools. Table 4.21 shows how they rated themselves regarding the attributes listed.

Table 4.21 reveals that respondents were adequately trained and rated themselves reasonably well in terms of ability and confidence, but very low in terms of the time at their disposal to utilize their newfound skills. As to the effect of the project on normal teaching duties, the majority (88%) in Table 4.22 shows that the WorLD programme has had some effect on their teaching duties. Half of the respondents felt there was a need for an additional staff member to help with the programme. Concerning the nature of training of such a teacher, half of the respondents stated that the additional staff member should be a teacher who will manage the library and provide first level technical support. The other half felt that such a person would be a purely technical person who should provide technical support.

Table 4. 20 Attributes acquired to manage school computer system N=8

Attribute	Number of teachers that acquired attribute	Percentage of teachers that acquired attribute
Ability – Skill to deliver first level support and maintenance	5	63
Time – Enough of it outside teaching duties to engage in collaborative projects	1	12
Confidence – To operate computers without fear of causing damage to the tool	2	25

Table 4.21 WorLD teachers' rating of their ability, time and confidence N=15

Attribute	Rating	Response	Percentage
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Ability	Fair – 0% to 50%	1	6.6
	Good – 51% to 74%	3	20
	Excellent – 75% to 100%	1	6.6
Time	Fair – 0% to 50%	1	6.6
	Good – 51% to 74%	1	6.6
	Excellent – 75% to 100%	1	6.6
Confidence	Fair – 0% to 50%	3	20
	Good – 51% to 74%	4	27
	Excellent – 75% to 100%	0	0
Total		8	100

Table 4.20 Depicts attributes acquired by teachers to manage school computer labs. Table 4.21 rates their ability, time and confidence and Table 4.22 provides the effect of project on teachers' normal classroom duties.

Table 4.22 Effect of project on normal classroom teaching N=8

Effect	Absolute response	Percentage response
Unable to manage computer system and engage in collaborative projects because of teaching load/duties	2	25
To a large extent	2	25
Minimal extent	3	38
Not at all	1	12
Total	8	100

The question then arose as to what support teachers had received during the period that the project was implemented in view of its novelty, and what the consequences of lack of support had been.

Many teachers had received a wide range of support during the WorLD pilot project during its implementation period. Figure 4.14 shows that half of the respondents received support in learning strategies and collaborative planning. The Table also shows that although there was emotional mentorship and technical support, these were provided to less than half of the

teachers. Two teachers were unfortunately not given any support at all. As to what support was provided by the principal of the school, Figure 4.15 reveals that although all teachers received some support from the principal of the school, the majority, 62%, received lukewarm support from their principal during the WorLD programme. The reasons why support was lukewarm makes interesting reading.

Figure 4.15 shows there had been no support from principals because many of them were ignorant of the role of ICT in education. Lack of resources, which is a combination of lack of funds and technical equipments, also played a significant part in the principals' attitude.

Figure 4.14 Support received by WorLD teachers during programme

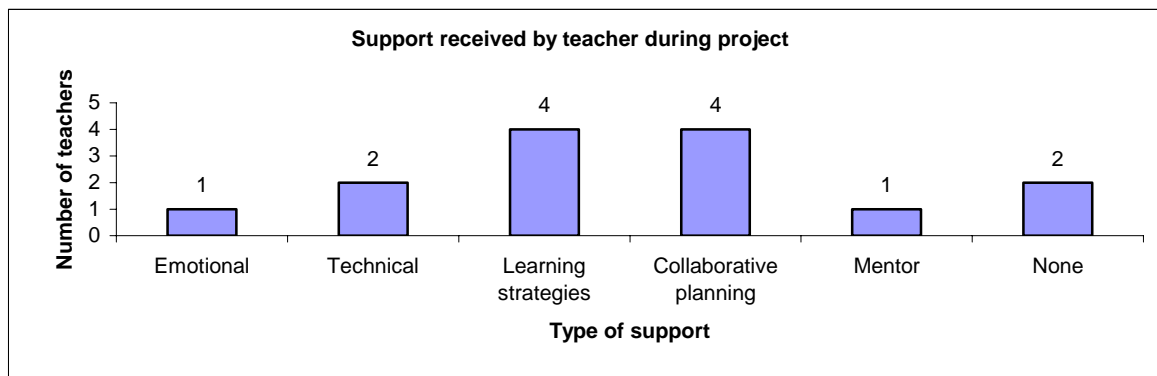


Figure 4.15 Support received from WorLD school principal

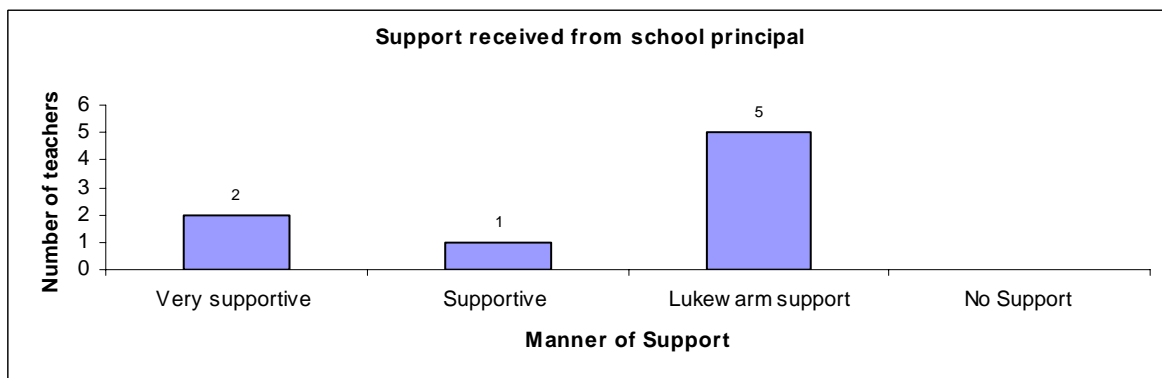


Table 4.23 Reasons for lack of support from school principals N=6

Reasons for lack of support	Absolute number	Percentage response
Ignorance of principal	3	50
Lack of technical resources	2	33
Lack of funds	1	17

Figure 4.14 provides data on support received by WorLD teachers during the project while Figure 4.15 explores the nature of support at the school management level. Table 4.23 provides data explaining the lack of support from school principal.

Table 4.24 outlines relevant questions relating to learners' English Language proficiency and sections in which data is located.

Table 4.24 Learners' English language proficiency level

Question	Data
4 What is the literacy levels of WorLD pupils in terms of reading, accessing and using information in the English language?	Sect 4.3.4
How do you rate your ability to read and write without assistance?	Table 4.25
Where students have problems with reading and writing indicate roughly the percentage range that experience such problems.	Figure 4.16
How do you rate your ability to read English texts from books?	Table 4.26
How do you rate your ability to read English texts from computers and the Internet?	Table 4.27
If your reading is not good, what do you think are responsible?	Table 4.28

4.3.4 Lack of proficiency in the English language as a hindrance to the use of ICT in schools

1 Reading and writing generally in WorLD schools

Education in areas in which this research was conducted is mainly provided in the English language, which is not the language spoken in learners' homes. The main source of information on the Internet is also in English. The listed factors, coupled with the fact that many of such schools lacked the resources with which to improve upon the English language,

necessitated an investigation into the possible lack of proficiency in the English language and what its effects were.

Educators were asked among other questions (Table 4.24) about the extent to which their learners were able to read and write without assistance.

Generally, WorLD respondent learners are able to read and write without assistance. Table 4.25 shows that (five, or (62%), of many WorLD learners, are able to read and write without assistance. The majority of educators indicate that, of the learners who are unable to read, serious reading problems prevail among such learners. Refer to Figure 4.16.

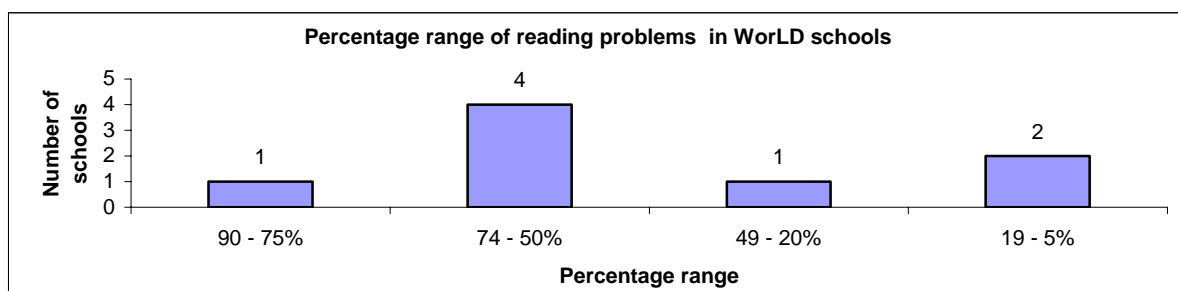
2 Accessing information from the Internet

Educators were asked about the extent to which students were able to read from the Internet. Only 12 % of learners are able to access information from the Internet without assistance. Educators also revealed that half of their learners cannot use the Internet without assistance and only 12 % of them said their learners could use the information on the Internet. Some of the educators (40%) indicated that a lack of resources at learners' homes was responsible for reading problems. Forty percent said that the problem was a lack of resources at the schools.

Table 4.25 Ability to read and write without assistance N=8

Reading and writing	Number of learners	Percentage
Ability to read and write	5	62
Not able to read and write	3	38

Figure 4.16 Range of reading problems in WorLD schools



4.3.4.1 Language proficiency

The ability to read and write in the English Language was more of a learner's problem than an educator's. The study sought to find out from the learners themselves how easy or difficult it was for them to access information in the English language.

The main question put to learners was what was learners' ability to read English texts from books and computers?

The majority (60%) of learners indicated that their ability to read English texts from books was very good (Table 4.26). Most learners 41 (91%) prefer to communicate in English at school. It is, however, a challenge for many (79%) learners to read very well from computers and the Internet (Table 4.27). Many of the respondent learners (56%) according to Table 4.28 attributed lack of excellent reading skills to lack of reading material in their homes.

Table 4.26 Ability to read English texts from books N=45

Rating	Response	Percentage
Excellent	12	27
Very good	15	33
Good	16	36
Fair	2	4

Table 4.27 Learners' ability to read from computers and the Internet N=45

Rating	Response	Percentage
Excellent	2	4
Very good	8	17
Good	15	34
Fair	20	45

Table 4.26 rates learners' ability to read from books, Table 4.27 depicts ability to read from computers and Table 4.28 provides data as to why reading was not as good as expected.

Table 4.28 Why reading was not as good as expected N=18

Reason why reading is fair	Response	Percentage
Lack of reading material at school	2	11
Lack of reading material at home	10	56
Local language as a means of instruction at school	2	11
Local language as a means of communication	4	22

Table 4.29 Utilisation of multimedia by WorLD schools

Question	Data
5 How far can multimedia fill the gap in the utilisation of ICT in South African WorLD schools?	4.3.5
How do you think multimedia as a computer product can help WorLD learners to improve upon knowledge and skill?	Table 4.30
Which of the minimum multimedia equipment do you have in your school?	Figure 4.16

Table 4.29 outlines questions relating to the use of multimedia in WorLD schools and the tables figures that provide the data.

4.3.5 Utilization of multimedia

This study investigated the use of multimedia in WorLD schools, as a basis for the future use of a multimedia system to stimulate learners' interest in the use of computers in education. Educators were asked as in Table 4.29 the extent to which multimedia systems were used in WorLD schools.

Only 40% of respondent teachers indicated that they had used multimedia. Concerning the combination used, one respondent (20 %) indicated the use of sound, text and image.

As to how multimedia would assist educators, the majority (75%) stated that multimedia can have a stimulating effect on the learning process at schools.

With regards to access and use of multimedia equipment, Figure 4.16 shows that no school has the entire minimum list of equipment that will support the use of multimedia in WorLD schools. The majority of respondent teachers (66%) indicated that they have the ability to utilize multimedia for teaching purposes with the skills they have acquired through the

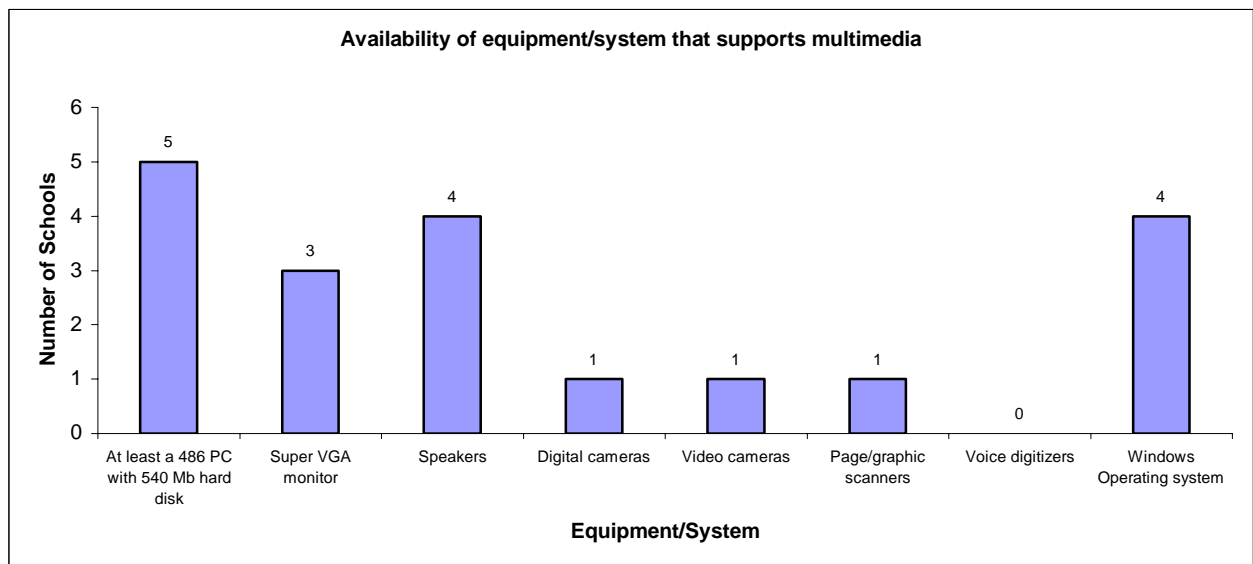
WorLD programme. Teachers who could not use multimedia felt they will need further training in multimedia computer skills.

Table 4.30 How multimedia aids ICT education N=37

Means of multimedia assistance in education	Response	Percentage response
Attract students to practise and acquire skills	5	62
Stimulate learners' learning process	6	75
Make up for learners' inability to read effectively	4	50
Enhance learners' concentration	4	50
Eliminate passive learning	5	62
Equip learners with independent learning habits	4	50
Build in curiosity and the quest for knowledge	5	62
Support learners' oral cultural background	4	50

Table 4.30 provides information on how multimedia aids ICT in education while Figure 4.17 details access to multimedia equipment in WorLD schools.

Figure 4.17 Access to equipment/system that supports multimedia



4.3.5.1 Utilization of multimedia by learners

The study investigated the view of learners regarding the use of multimedia for learning.

Most of them (37, or (82%) have television sets at home and over half of them (52%) watch television very often, while 12% do not watch television at all. A majority of 38 learners (88%) out of 43 prefer sound as an additional medium when using a computer for learning. Learners have a high interest, using multimedia from the equipment that they have at home.

Table 4.31 Benefits and challenges of the WorLD programme

Question	Data
6 What are the benefits and challenges of the WorLD programme?	Section 4.3.6
In what way has the programme been of benefit to you?	Table 4.32
In what ways has the programme been of benefit to the school?	Table 4.33
In what ways has the project been a challenge to the project teacher?	Table 4.34
In what ways has the programme been a hindrance to the school?	Table 4.35
What problems do you anticipate in the future with the introduction of computers in your school?	Table 4.36
What suggestions do you have to improve on the WorLD programme?	Table 4.37
How frequently do you use computers for class exercises?	Table 4.38
What collaborative projects were learners involved in?	Table 4.39
In what way do you think a computer as a tool helps you to improve upon your studies?	Table 4.40
What is the most important thing you should do to derive the full benefit from learning with computers?	Table 4.41
What suggestions do you have which will help improve upon the projects in your school?	Table 4.42

Table 4.31 details questions relating to the benefits and challenges of the WorLD programme in South Africa.

4.3.6 Benefits and challenges of the WorLD programme

The study investigated the benefits and challenges that WorLD schools were exposed to.

1 Benefits of the project to WorLD Schools

Educators were asked to select from a list their choices regarding the benefits of the project to them as individuals and to their schools.

Many of the project co-ordinators, (5(62%), in Table 4.32, felt that the WorLD programme enabled them to equip themselves with computer and information skills. Table 4.33, for example, shows that the majority of respondents (75%) were of the opinion that learners had acquired skills which they will be able to utilize in work and further education environments.

Table 4.32 Benefits of WorLD programme to the project co-ordinator N=8

Programme benefit	Response	Percentage
Introduced modern approaches to teaching and learning	3	37
Introduced new insights into education	4	50
Introduced new challenges to my professional development	4	50
Ushered me into the global educational arena	3	37
Enabled me to develop myself as far as the new approach to education is concerned	4	50
Enabled me to equip myself with computer and information skills	5	62

Table 4.33 Benefit of WorLD programme to the school N=8

Benefit to the school	Response	Percentage
School has been put on the information superhighway	2	25
Modern educational equipment has become part of the school's teaching and learning environment	3	37
Learners are able to engage in collaborative learning	4	50
Learners acquire skills which they will be able to utilize in work and further education environments	6	75
Infrastructure and logistics of school has improved	1	12

Table 4.32 shows the benefits WorLD schools have derived from the project coordinators from coordinators perspective while table 4.33 shows benefits to the school.

2 Challenges posed by project to WorLD schools

Educators were asked to select from a list what the challenges regarding the project were to teachers and to their schools.

The majority of respondent educators (75%) felt, as evidenced in Table 4.34, that the programme has given them more work to do and added responsibility, without additional remuneration. Interestingly, only one respondent (12%) cannot perform normal teaching duties. Three (37%) have also experienced conflicts with their principals because of the programme. Half of the respondents (50%) in Table 4.35 saw the WorLD programme as an expensive venture to undertake. Table 4.36 shows that many respondents (75%) see the cost of maintaining the computer system as a major problem in the future.

Table 4.34 Challenges of WorLD programme for teacher/co-ordinator N=8

Challenge	Response	Percentage
More work and added responsibility without additional pay	6	75
Inability to fulfil normal teaching role	1	12
Conflicts with other members of staff	2	25
Un-refunded financial expenditure	1	12
Conflict with school principal	3	37

Table 4.35 Hindrances posed by the WorLD programme N=8

Hindrance	Teacher/co-ordinator
Students spend more time in computer lab, at the expense of examination subjects	3
It is an expensive venture	4
No hindrance	1

Table 4.36 Future problems N=8

Future problems	Teacher/co-ordinator
Cost of maintaining the system may be out of reach of schools/parents	6
Teachers who will not update their knowledge will frustrate the system	3
None	1

Tables 4.34 shows the challenges posed by the WorLD project from the coordinator's

perspective Table 4.35 depicts the challenges and Table 4.36 the future problems.

3 *Improving upon the use of computers in schools*

Educators were asked to suggest means by which the use of computers in WorLD schools could be improved upon.

Half of the teachers in Table 4.37 were of the view that there was a need to provide more and better computer equipment. The other half felt that more and better technical training was needed. Computer courses as subjects in schools are the least favoured suggestion to improve computer utilization.

Table 4.37 Suggestions to improve upon the use of computers in schools N=8

Suggestion	Response	Percentage
Attract more teachers to the idea	3	37
Provide more and better computer equipment	4	50
Computer courses as subjects in schools	2	25
Schools must be linked to the Internet	3	37
More and better technical training	4	50

4.3.6.1 *Use of computers for learning*

It is gratifying that the majority of learners (23, or 53%) use computers for class exercises. Table 4.38, however, shows that (21 (47%) of the learners do not use computers at all for class exercises. Table 4.39 shows that the majority (24, or 56%) of learners were involved in at least one collaborative project. In all, a large number, (38 (90%)), of respondents indicated that they enjoyed learning at school with computers.

Table 4.38 Frequency of using computers for class exercises N=44

Frequency	Response	Percentage
Very often	15	35
Often	8	18
Not at all	21	47

Table 4.37 provides suggestions to improve upon the use of computers in schools; table 4.38 shows the frequency of use of computers for class exercises and Table 4.39 outlines the number of collaborative projects that learners had undertaken.

Table 4.39 Collaborative projects that learners were involved in N=43

Number of projects	Response	Percentage
One	24	56
Two	3	6
Three	1	3
None	15	35

4.3.6.2 Using computers for education advantages and challenges

The present study elicited from learners, who are the ultimate users of ICTs for education, what, in their view, the advantages and challenges of education with ICTs were.

Learners were asked how the computer could help improve their studies. From a list provided (Table 4.40), the majority (31%) felt that the computer was a tool that helps learning, followed by learners' opinion that computers provide much information. Many learners, 18 (43%), believe that learning computer programming will help them derive the full benefits of learning with computers. Only 10 learners (24%) indicated that more practice of the correct use of applications would help learners to derive full benefits from the computer.

The majority of (31 or 69%) believe that introducing computer studies as a subject will help improve the WorLD programme and the utilization of computers in schools.

Table 4.40 How the computer can help improve learners' studies N=39

How computers help with studies	Response	Percentage response
Help concentrate on learning	3	8
Aid learning	12	31
Communicate and share knowledge	4	10
Provide access to lots of information	8	21
Develop learning skills	5	13
Provide fun while learning	6	15

Not sure	1	2
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Table 4.41 Deriving the full benefits from learning with computers N=42

Action	Response	Percentage
Read more about computers	14	33
Learn computer programming	18	43
Practise to learn the correct use of applications	10	24

While Table 4.40 shows how the computer can help improve studies from the learner's perspective, Table 4.41 outlines learners' views of deriving full benefits from learning with computers and Table 4.42 provides suggestions on how to improve upon the WorLD programme.

Table 4.42 Suggestions to help improve the WorLD programme N=45

Suggestion	Response	Percentage
Provide/improve access to computers and the Internet	10	22
Introduce computer studies as a subject	31	69
Sharing ideas with other schools	4	9

Chapter 5

Interpretation of data

5.1 Introduction

Chapter 5 interprets the data presented in Chapter 4. To do this, the researcher generalized the findings of the study sample to the whole population (WorLD participant teachers and learners). It is noted that the small sample size limited the generalisability of the study. Research findings and conclusions drawn are therefore grounded in the extensive literature review undertaken, which emphasises the context in which the study was conducted.

Interpretation entails an analysis of relevant literature and survey data, based upon the research questions that underpin the study. The questions, which are outlined in Chapter 1, are:

- How successful was the training provided to teachers and students in WorLD schools (in terms of enabling them to utilize computers for collaborative school projects)?
- What information resources (computer laboratories, Internet, libraries, multimedia centres) exist in the schools and do the schools have media teachers?
- To what extent are the WorLD teachers able to handle school projects, attend to computer systems and teach their normal school lessons?
- What is the literacy level of WorLD school pupils in terms of reading, accessing and using information in the English language?
- How far can multimedia fill the gap in the utilization of ICT in South African WorLD schools?
- What other factors contribute to the success or failure of the WorLD programme in South Africa?

Lundall and Howell³⁷ (2000: 2) state that several factors can determine the success or failure of ICT in schools. Some of these factors, which have been the basis of the present study, include networks of connectivity and structured and continuous programmes to train teachers to use the new technology for educational purposes. The two researchers add that ICT should be integrated, from the start, into the teaching and learning process and into the structures of administration and management. In the following section research questions are presented, analysed and compared with related literature.

5.2 How successful was the training provided to teachers and learners in WorLD schools (in terms of enabling them to utilize computers for collaborative school projects)?

5.2.1 Training of teachers

The training of teachers and learners was a key component of the WorLD programme. Training was important, as it provides not only knowledge, but also the hands-on skills that enable the computer user to meet the programme's objectives. Training was also important because 62 % of participating teachers and learners had never used a computer before the introduction of the programme to their school. Training is therefore a useful benchmark to evaluate the WorLD programme in South Africa.

The findings of this study show that all teachers involved in the WorLD programme were trained (Tables 4.4 and Figure 4.2) and had computers to practise on after training. Most teachers were trained satisfactorily in computer applications and collaborative school projects. The aspect of training found to be most satisfactory was Microsoft Word.

³⁷ Lundall and Howell conducted one of the first most comprehensive studies on ICT in schools in South Africa. The project, entitled *Computers in Schools*, was conducted under the auspices of the Education Policy Unit of the University of the Western Cape and sponsored by the International Development Research Centre (IDRC).

Technical training of teachers, on the other hand, was found to be unsatisfactory. No teacher was trained in the UNIX operating system (Table 4.5 and Figure 4.3). This was a major drawback for the WorLD programme, because the e-mail system used during the programme is based on the UNIX operating system. There was a major need for effective technical training because most of the WorLD computers were refurbished and often non-functional, requiring constant maintenance. The majority of teachers (88%) stated that technical training was critical to be able to maintain the programme. A lack of effective technical training was therefore a serious flaw in the WorLD programme in South Africa. McGhee and Kozma (2001:5) support this finding, namely that, in South Africa, the variety of training support received by teachers was low and the South African national score on the teacher training benchmark was lower than the African and WorLD programme average.

It is noteworthy from this survey (Table 4.6) that many teachers embark on efforts to equip themselves with ICT training. The enthusiasm of the educators for taking private ICT courses bodes well for ICT education in schools in South Africa.

The lack of effective technical training, evidenced by the present study, suggests that teachers and learners will have to familiarise themselves with the technology, as observed by Goldman *et al.* (1999), before settling down to integrate technology with content. This means that the period of integrating ICT into education will take longer than previously expected. Schools may also have to resort to the following suggested solutions (Lundall and Howell 2000: 43), to keep their computer Networks functioning. The solutions include:

- outsourcing some of the work regarding computer networks;
- sharing technical staff with other schools in the area;
- combining certain roles such as technical support staff.

The recommended solutions are critical in situations such as the WorLD programme, where schools use refurbished computers, which often break down. It is also important for school managers using ICT to recognize that the best plans will remain unfulfilled if there is lack of communication between technical and educational functions.

5.2.2 Training of learners

Training of learners has also not been satisfactory. Thirty-six per cent of WorLD learners were not trained at all and 40 per cent of those trained were not trained well enough (Figure 4.7). Learners spent less time being trained than their educators (Figure 4.5, Tables 4.7 and 4.8). Fifty-three per cent of learners were trained for less than three hours a day; all teachers were trained for three hours or more per day. No training was done in database systems or programming skills for learners or teachers (Figure 4.2 and 4.8), even though this had been stressed in the literature (Hawkridge, Jaworski and McMahon 1990:15 and Clyde 1997). No training regarding information skills was provided for learners, even though some teachers had been exposed to such training.

A number of writers (Addo 1999, 2001; Holland 1999; Clyde 1997; Hawkridge, Nahl and Harada 1996 and Kafai and Bates 1997) emphasized that training and skills development for learners are prerequisites for the utilization of computers in education. Clyde (1997: 48) states that to be able to use a computer for educational purposes one requires “the knowledge and skills which are related to the hardware, the system, the software, the information source.”

The findings of the present study show that not enough skill and confidence in using ICT was developed among learners. This is because only seven per cent of learners always had access to a computer to use for practice after training sessions. Thirty-six per cent of learners trained did not have access to computers to practise on after training.

One may argue that WorLD learners would receive continuous training as the programme progressed. The importance of mastering computer skills, stressed by Nahl and Harada (1996) and Kafai and Bates (1997), cannot be over-emphasised. It must also be noted that learners not skilled could be intimidated in their use of computers during the WorLD programme, as was observed by Holland (1999).

Learners would have performed better if they had been trained adequately. Nahl and Harada

(1996), for example, found that students who reported that they were more experienced in the use of computers performed significantly better than those with less experience. Kafai and Bates (1997) conclude that not only do students with more Internet experience dominate the computer interaction process, but those with more computer experience become the teachers of search teams. Nahl and Harada (1996: 203) advise that self-confidence, *which can only be attained through practice with computers*, is an important factor in an information search process.

Findings relating to the implications of lack of adequate learner training are supported by the conclusions of Addo (1999, 2001), in a research project carried out in areas in which some WorLD schools are located. The majority of learners could not use computers effectively for a schools' online environmental education project, because they had not attained the required computer and information retrieval competencies. Sagahyroom (1995), quoted in Addo (2001), states that in Kenya and other developing countries the quality of in-service training was crucial and more important than the nature of the hardware and software used in ICT utilization in education.

The findings of the present study draw a parallel with a similar one conducted by Bot (1999:7), namely that only ten per cent of learners always used computers for learning, and only six per cent of teachers always used the tool for teaching in schools where computers exist. It is hoped that the Educator Development Network online training, embarked upon by SchoolNet South Africa, will be able to provide the clear strategy regarding the training of teachers, and therefore learners, in previously unresourced schools, thereby integrating computers into the teaching and learning process in South Africa.

5.2.3 How far does the existing pedagogy in WorLD schools

support computer-based teaching?

This study has found that, apart from the project team and the research-based teaching methods, WorLD teachers are not familiar with, and do not use, teaching methods that support the use of ICT in education (Figure 4.4). It is also evident that, apart from the research-based teaching method introduced in some of the WorLD schools, teachers have not been trained in most of the methods for the implementation of the programme.

Researchers and writers such as O’Kennedy (1995); Johnson (1995); De Villiers (1998); Karaliotas (1997) & Govender (1999), made it clear that the utilization of ICT in education is possible only with certain teaching models. These models have been analysed in Chapter 2 (Section 2.3.2). The models are:

- the project-based teaching method;
- the student team method;
- the constructivist method;
- the research-based method;
- the system-based method;
- the authentic teaching method.

These models essentially place the learner in the position of initiating and taking charge of the learning process, while the teacher acts as facilitator, mediator or coach.

Bot (1999: 7) found that, in certain provinces of South Africa, only a few learners solve problems on their own, or participate in learning activities. She concludes that teaching methodologies in some provinces still rely on what is termed ‘chalk and talk’ and “it seems therefore that the methodology required to effect computer-based education, which requires active learner participation, has still a long way to go in its infusion into the education process in South Africa and this needs to be addressed” (Bot 1999: 7).

An evaluation of the WorLD programme in five countries (Chile, Paraguay, Peru, Senegal and Uganda) (Kozma *et al.*, 1999) found that the pedagogical approach was a novelty for

African schools that participated in the programme.

The present study establishes that the existing pedagogy in WorLD schools does not support computer-based teaching. This finding supports an earlier one of Govender (1999), who concludes that South African schoolteachers do not fully understand the concept of utilizing educational technology in schools. Efforts are being made by teachers themselves and the WorLD facilitators to develop the teaching models. Such efforts, though laudable, seem inadequate to address teachers' knowledge and skill gaps in ICT teaching models in South African schools. These findings show that full integration of ICT education into teaching and learning will take some time, not only in the WorLD programme but in other like projects.

According to Lundall and Howell (2000: 46), proponents of quality teacher training believe that it would have been ideal if teachers were trained during professional stages to appreciate the use of computers in their practice and acquire the necessary skills before entering the classroom. Demand on services requiring the use of ICT in schools in its nascent stage makes such training difficult. ICT training therefore seems to favour in-service training, where many teachers acquire only the basic skills, and a little confidence, before going into the class.

Teachers require training that integrates ICT into curricula to design courses that will convey both content and skills. Most importantly, teachers must be able to collaborate and work in teams, across job categories and, increasingly, across borders. Training in the use of ICT, therefore, has to be part of a much richer education for teachers and must address issues of pedagogy in the context of global curriculum change (Lundall and Howell 2000: 46).

The opinion of de Moura Castro (1999) is that developing countries will only reap the benefits of the ideal kind of training many years from now. While developing countries may not be able to afford the ICT priority afforded to teachers in developed countries, the need to include key components into professional in-service training and pre-teacher training is critical.

5.3 What information resources (computer laboratories,

Internet, libraries, multimedia centres) exist in the schools and do the schools have media teachers?

The present study (Figures 4.11, 4.12 and Table 4.14), shows that most WorLD schools have fewer than the minimum required information resources (computer networked laboratories, Internet access, libraries, multimedia centres) and media teachers necessary to effect computer-based education. It is also evident that the number of functioning computers at WorLD schools, software and, more importantly, the Internet access available during the project, makes it impossible for any effective collaborative projects to take place.

Other technologies, namely television, video, radio and overhead projectors, which support technology-based education, exist in most schools. Seven of the WorLD schools included in this study have computer laboratories. Three schools have media centres, two have media teacher/librarians and two have regular Internet access. None of the sampled schools has a multimedia centre or Network controller (Table 4.11). There is an average of 14 computers per school (Table 4.15). There is an average of five computers with CD-ROM drives (Table 4.16). A number of schools still have computers, with Windows 95 operating systems (Table 18), which Microsoft software vendors no longer support. While many schools have television sets, few schools have slide or data projectors (Figure 4.12). Evidence from this research shows that better-resourced schools often support under-resourced schools in South Africa.

Significantly, only two sampled schools (25%) have regular Internet access. This is

significant, because Internet access is a basic factor of the project, since the objective of the WorLD programme was collaborative online projects with other learners across the world. Also, in 60 per cent of the schools, only one computer was connected to the Internet. This is a serious hindrance for collaborative projects. In one of the schools, the researcher found that the computer connected to the Internet was located in the principal's office, which means that no collaborative project could take place in that school. It is also important to point out that most teachers (62%) do not use information from the Internet for education because the Internet was often unavailable. This finding is no different from the case of Mozambique, where McGhee & Kozma (2001) report that 65 per cent of teachers reported that the lack of Internet access was a major barrier to the implementation of the WorLD programme.

Many authors (Liddell, Masilela, Rapodile & Strydom 1990; Radebe 1997; Gordon 1997, Todd 1997; SAIDE 1998; World Bank 1999 & Addo 1999) state that an adequate school resource environment, with the appropriate logistics, infrastructure and personnel, is a *sine qua non* for good-quality ICT education. A study by the World Bank (Liddell, Masilela, Rapodile & Strydom 1990) suggests that the provision of good educational material is the most cost-effective way of improving educational quality. Addo (1999: 86) found that the adequacy of infrastructure and logistics in schools is conditional to the availability and use of ICT for education. Important elements for utilizing ICT in education are a school computer laboratory, a school library, a school librarian/media teacher, electricity, a telephone and security against theft.

The situation in South Africa (which is gradually improving, as shown by Tables 2.3 and 2.4) is, according to Gordon (1997: 40), schools without walls, teachers without teaching skills

and full knowledge of the subjects they teach, and the need for students to read, write and reason. This has prompted Radebe (1997: 224) to suggest, correctly, that computers did not feature as a factor in education in South Africa. Lundall and Howell (2000: 157) recommend that technologies in education should not be viewed in isolation, but rather seen from the broader societal distribution of resources. Bot (1999:3) observed that, in South Africa, roughly six out of every ten teachers said that a lack of teaching materials considerably limited their teaching. This lack had a serious effect on the morale of teachers nationally.

5.4 To what extent are the WorLD teachers able to handle school projects, attend to computer systems and teach their normal school lessons?

All teachers participating in the WorLD programme were trained to provide ICT education. The present study found that not only were the teachers adequately trained but they rated themselves highly, in terms of ability and confidence. Conversely, however, the study revealed that there was not enough time to utilize the skills acquired in WorLD schools. The teachers rated themselves very low in terms of time to discharge activities relating to WorLD programmes (Tables 4.20 & 4.21).

Unavailability of time to deliver on WorLD programmes is further shown by the fact that 88% of teachers indicated that their involvement in the programme had affected their teaching duties. The feature of unavailability of time to deliver on WorLD programmes is

also reported in other WorLD countries on the African continent by a WorLD country report (McGhee and Kozma 2001). The report submitted that, in Ghana, more than half (54%) of the teachers reported that a lack of time to implement WorLD programmes, given school curriculum requirements and the limited school day, was a major barrier. Similar sentiments relating to lack of time were reported by teachers from almost all the other WorLD countries in Africa, namely Mauritania, South Africa, Senegal and Uganda. A similar finding was made by Tshenye and Perold (2000:15), in reviewing other School ICT projects, in the Eastern Cape and the Northern Province of South Africa, as evidenced in the literature review of this study. Lack of time to deliver on WorLD programmes is further corroborated by a study of the WorLD programme in Chile, Paraguay, Peru, Senegal and Uganda. Kozma *et al.* (1999) found that a large number of teachers mentioned the difficulty of finding time for computer-related activities in their schools.

The effect of the WorLD programme on teachers' normal duties in South Africa is exacerbated by the fact that only minimum support was provided to teachers, not only technically but, worst of all, by the schools' principals, many of whom were ignorant of the programme and the role of ICT in education. Bot (1999:6) confirms teachers' perception of principals as lacking knowledge, and therefore not supporting school ICT projects, in that more than half of the principals lacked the capacity to support their staff.

With the lack of time to deliver on WorLD programmes and their effect on teachers, one would have thought that support from various sources would raise the morale of teachers who were not paid to undertake ICT projects in their schools. More often than not, school ICT projects marginalize the school librarian, who is a critical personnel resource in the integration of any form of information technology into the curriculum. The role of the school library in the WorLD ICT resource model testifies to the crucial role of the school librarian.

According to Lundall and Howell (2000: 44), teachers often do not know what they can do with technology. The tendency was to use ICT simply to automate traditional teaching methods. The need for support to provide a resource base to guide teachers is a critical factor and also for an advisor, who can facilitate group work among teachers so that there is a

sharing of experience and, it is hoped, collaboration around projects. Lundall and Howell (2000) maintain that such practice was prevalent in the developed countries of the United States of America and Britain. They indicate that the process involved the training of **Master Trainers**, who then serve as resources for their colleagues. Lundall and Howell (2000:44) stress that such expertise could be from other staff, such as librarians and computer co-ordinators, or from volunteers from business, the parent body or student groups. In reality it is often these support people, rather than teachers, who supervise the students.

O' Kennedy (1995:7) was correct in his observation that teachers who man computer systems were already overloaded with work and the additional load of being Network manager would be too much to cope with. Maintaining a computer network in a school is an expensive undertaking and it requires a full-time job position.

5.5 What is the literacy level of WorLD school pupils in terms of reading, accessing and using information in the English language?

It is evident from the present study that the majority of learners (62%) are able to read (that is, access content in books) and write without assistance (Table 4.28). The study reveals, however, that where reading problems exist, close to two-thirds of learners experience acute reading problems, ranging from 50 to 90% (Figure 4.16). The study also shows that only 12% of learners could access information from the Internet without assistance and only about half of learners could read from the Internet.

Learners' inability to read and access information from the Internet has been attributed to lack of resources at home and at school (Table 4.28). The use of the local language as a means of instruction and communication also plays a significant role in limiting reading and accessing of information which is primarily in the English language (Table 4.28).

Lack of information skills is a major likely reason for the inability to access information from the Internet. This is because no learner has been trained in information skills (Figure 4.8).

The non-involvement of the school librarian in the project in schools contributes, in no uncertain terms, to the lack of information skills. It is noted that 89% of learners do not have a computer at home and 80% of those who have, indicate that the computers are not

connected to the Internet. It is therefore not surprising that nearly half, or 47%, of the learners did not use a computer for class exercises during the programme (Table 4.38) and 35% have not been involved in any collaborative project (Table 4.39).

Available literature (Blacquiere 1989; Macdonald 1990; Radebe 1994, 1997; Bouwer 1998) corroborates frustrations experienced by learners in this study about using the English language as a second language for education. The literature not only dwells on the causes, which in many instances are the non-availability of resources at learners' homes and at schools, but it elaborates on the related consequent effects on learners' studies.

Heugh, Siegruhn & Plludelemann (1995:46) and NEPI (1992:72) have made it clear that in a situation where a learner's home language is not the language of learning in a school, the phenomenon of language-cum-cognitive difficulty exacerbates existing learning difficulties. Bouwer (1998:226) notes that research demonstrates that it is virtually crippling to grapple with content in a language inadequately understood, or mastered at the lower competence level of basic interactive communication skills.

The school resource situation, especially library provision (Table 2.3), corroborated in this study by Figures 4.10 and 4.11, justifies the views of Radebe (1997), that where libraries do not exist in schools for pupils to read in the language of instruction, their grasping of content in non-mother-tongue languages is impeded.

This study exposes the lack of resources at learners' homes and the absence of the culture of literacy in many black African families. This creates problems for learners, with parents and guardians unable to assist, as indicated by Bouwer (1998: 226). This situation, according to Blacquiere (1989) and Radebe (1994), manifests itself in many such students' lack of critical thinking skills, even at higher education levels in South Africa.

While Blacquiere (1989:78) concludes that black students at tertiary institutions were unable to read as efficiently as their white peers because they were intellectually malnourished, Radebe (1994:43) found that, in almost all tertiary institutions, the most noticeable concern in students' inadequacies in terms of their preparedness was information illiteracy, which was along racial lines. Both writers attribute the problems to the lack of reading resources in the schools. Many black learners in South Africa no doubt view as incapacitating their poorly developed skills in the language they use for learning (Macdonald 1990:48-49).

This research has shown (Figure 4.16) that the inability of pupils to retrieve information from computers in the WorLD programme is not only a result of scarce reading resource provision but also of lack of information skills. It is logical that if as many as 62% of learners (Table 4.25) can read without assistance, but only 12% can retrieve information from the Internet without assistance (Table 4.27), a possible reason for the low information retrieval situation is lack of information skills.

Accessing content in an information retrieval system is not the only drawback of information seekers who use information retrieval systems which use their second language. Information retrieval performed in the information seeker's second language raises relevant issues such as command of the computer language, command of keywords, the level of education and the level of experience, all of which are lacking among many teachers and learners in schools in South Africa (Radebe 1994).

Nahl and Harada (1996:199) point out that, students often use natural language, which is not compatible with the online catalogue's controlled language. This situation could be a problem for many learners due to lack of information skills. In the present study only 12% of WorLD learners were able to retrieve information from computers without assistance.

A study by Large *et al.*, (1994:500) concluded that retrieving information from all databases involves some cognitive activity. These activities are alluded to in section 2.3.4 of the

literature survey of the present study and dovetail with the conclusions of Large *et al.*, (1994:500), namely that the process of information retrieval is affected by personal characteristics such as knowledge, experience, information need and the information system being used. These are attributes which are lacking in many schools in South Africa because of the non-provision of information skills in many schools, as has been established by the present study. Radebe (1994:43) raised the concern that, in many tertiary institutions in South Africa, a noticeable concern in students' preparedness was information illiteracy.

Findings of the famous Schools' Network Action Project, dubbed the SNAP-Dragon project of the University of California Los Angeles (UCLA) by Kafai and Bates (1997), are still valid today. Conclusions from the research are that, though the Internet supported free text, students were not able to select good sites for their projects because they used the titles of their project to decide on the sites from which they wanted to retrieve information, instead of keywords. It was also found in the SNAP-Dragon study that using rudiments of Boolean logic enhanced the search skills of students.

The essence of information skills in this study brings into focus the role of the media teacher, presented in section 2.4.3 of the literature survey of this study. According to Kafai and Bates (1997), the success of the SNAP-Dragon project was due to the role played by skilled Library and Information Science (LIS) Interns, who acted as *de facto* librarians during the project. Silva (1995:243) noted that librarians have been key resources in the introduction and success of Internet classroom activities and have been resource persons offering advice, instruction and even technical support to teachers. The number of WorLD schools with media teachers/librarians (Figure 4.9) does not favour the expected role of media teachers in the

project in South Africa. It was not surprising that teachers, many of whom had not used school libraries in the past and were unaware of their functions, were undecided about the qualifications of the additional staff member - whether he or she should be a librarian or a purely technical person each received a 50% response.

This researcher agrees with concerned teachers that, as previously disadvantaged schools and pupils cannot immediately escape the legacy of past educational policies, scars still exist in terms of infrastructure, logistics and the know-how of teachers, which reflect the abilities of students in schools. Such students lack the foundation and resources to undertake rigorous computer-based education. Where the Internet content is not yet available in the local language for easy access, an alternative computer system is required to provide further motivation and to address the problems of illiteracy, inadequate teacher training and low learner motivation found in the WorLD and many other schools in South Africa. Such a system, as suggested by concerned WorLD teachers in KwaZulu-Natal, should be one of computer-based multimedia.

5.6 How far can multimedia fill the gap in the utilization of ICT in South African WorLD schools?

This study shows that 40% of WorLD teachers have used a multimedia computer system before. Of the 40%, half have used a combination of text, sound and image. Many of the teachers responded positively to the means by which multimedia can assist in ICT education. The largest response (75%) believes that multimedia will stimulate the learning process of students (Table 4.30)

A number of authors (Gates 1994; Spranger 1997; Malapile 1996; and de Horowitz 1993) share the response of the majority of WorLD teachers, namely that multimedia has a positive role in ICT education. While Malapile writes from a black African setting that utilization of multimedia will help rekindle in learners the curiosity and the quest for knowledge, Gates (1994:170) observes that multimedia stimulates all learning paths by offering information through pictures, written text, sound animation and video. Many of the teachers (62%) indicated that multimedia will attract students to practise and acquire skills. This, the researcher believes, should be a tonic for the WorLD programme. As the majority of learners (82%) have television sets at home and over half (52%) view television very often, it is certain that a multimedia system will attract learners to ICT-facilitated learning. This is reinforced by the fact that 38% of the learners indicated that they prefer sound as an additional medium in using a computer for learning.

Edelstein (1995:44) emphasises the fact that multimedia products are expensive. Download time, which is the time taken to convert the data in computer format to information accessible to the user, can be frustratingly long, depending upon the quality of the equipment being used (DiNucci, Giuidice and Stiles 1998:24). Edelstein (1995:44) categorised a set of the minimum equipment requirements to determine the applicability of a multimedia system.

The present study has found that no WorLD school has all the minimum requirements to utilise multimedia (Figure 4.16.). The majority of teachers (66%) have, however, indicated that with the skills they have acquired they will be able to utilise multimedia for teaching purposes. Teachers who feel they cannot utilise multimedia for educational purposes indicated that they will require further training in technical skills that relate to multimedia.

5.7 What other factors contribute to the success or failure of the WorLD programme in South Africa?

5.7.1 Success of the WorLD programme

The World Links for Development (WorLD) Programme is one of the flagship projects of SchoolNet South Africa. The organization is engaged in bridging the gap between policy and the implementation of ICT education in South Africa. It is also addressing the equitable utilization of ICT for teaching and learning as one of its objectives. The WorLD programme therefore focused solely on the previously non-resourced schools, which had never used computers for education.

Sixty-two percent of the teachers (Table 4.32) felt that the programme had equipped them with computer and information skills, which, according to Clyde (1997:48), are the skills required for living beyond mere survival in an information economy. Half of the teachers felt that the programme had not only introduced new insights into education for them but enabled them to develop themselves as far as new approaches to education were concerned. Teachers reported similar comments across the African continent, according to McGhee and Kozma (2001).

Almost two-thirds of teachers (62%) felt that the school had provided learners with skills which they will utilize in work situations and further education. Lundall and Howell (2000: 92) found similar sentiments with the majority of teachers. In effect, enthusiasm of the teachers in applying ICT to education related only to the social and direct benefits to teachers and learners in the previously non-resourced areas in South Africa. The issue of integrating ICT into education has yet to catch up with learners and teachers.

Thirty-one percent of learners indicated that the computer was a tool that aids the learning process. Twenty-one percent felt that it provided access to much information and 15% indicated that it was a tool that provided fun during the learning process (Table 4.40) Sixty-eight percent felt that there was a need to introduce the study of computer programming in order to derive the full benefits of learning with computers

5.7.2 Challenges facing the WorLD programme in South Africa

The WorLD programme presented a number of challenges, which in certain cases could have contributed to a near failure to achieve the programme's objectives in South Africa.

5.7.2.1 Training

Training of teachers and learners was a key component of the WorLD programme. Although teachers were adequately trained, transfer of knowledge and skills to learners who required such knowledge and skills to make effective project objectives could not take place, because of lack of capacity in terms of time. It was not surprising that the majority of teachers indicated that the programme had provided them with more work and added responsibility. Many said that the programme had caused conflict between them and their school principals.

5.7.2.2 Access to computers and Internet Connectivity

The present study found that access to working computers was a major problem. An average of only 14 working computers to a WorLD school is considered a limited number. The study shows that as many as 33 learners on average per school (Table 3.3) took part in the project, which means that there were more than two learners to a computer. Lack of adequate hardware was reported as a major barrier to the WorLD programme in the South African Country Report (McGhee and Kozma: 2001). In addition to the number of persons per computer and inadequacy of hardware was the question of Internet availability, which was only 25%.

Half of the teachers suggested that the provision of more and better computer equipment and more and better technical training would improve the use of computers for education in the WorLD programme (Table 4.37). This reinforces the point made earlier concerning refurbished computers.

Sixty-nine percent of learners (Table 4.42) believe that the introduction of computer studies as a subject in schools will help improve the rate of utilization of the computer as a learning tool and hence improve the WorLD programme. It is supposed that the introduction of computer studies will make provision for a dedicated teacher and capacity in terms of time and personnel for computer-related subjects and issues, not only in WorLD schools but also in the future integration of ICT in education in South Africa.

5.7.2.3 *Cost*

Cost was not investigated in this study. It was, however, an issue that impinged on the immediate utilization and sustainability of the programme. Half (50%) of the teachers indicated that the programme was an expensive venture to be undertaken. Sixty-two percent of them concluded that the cost of maintaining the computer system may be out of the reach of the school in the future. Telephone costs were reported as a major barrier to the implementation of the WorLD programme in Senegal.

Lundall and Howell (2000) point out that cost, and particularly the cost of Internet access, has been cited as the most important factor for limiting Internet use in schools in South Africa. Table 4.36 draws attention to cost as an important phenomenon. As pointed out in James (2001:105), the non-availability of financial sustainability models in “soft” funding projects from grants provided by funding agencies render the medium- to long-term future of projects very fragile and with limited social impact. In this case evidence suggests that financial problems were visible in the short-term period of the project.

5.8 Summary

Chapter 5 provided a detailed analysis of the research data and literature available to determine the findings of the study. The study established that, whereas WorLD teachers were adequately trained to deliver ICT education, technical and learner training was not adequate. It was also established that the existing pedagogy, as well as existing information resources in WorLD schools, do not support ICT education. The study found that, in spite of adequate teacher training, there was not enough time to implement the skills gained by teachers in the WorLD programme.

Learners did not experience problems with reading or accessing content in WorLD schools. Nevertheless, they were unable to access information from computers for collaborative projects because they lacked the skills to do so. While multimedia can be used effectively to

enhance ICT education, most schools do not have the required equipment to use multimedia.

Finally, although the cost of computer systems was not a feature of this study, it was observed as a major factor in utilizing ICT in the WorLD programme. The project may not be sustained if the cost factor is not given attention and resolved.

Chapter 6

Summary of the findings of the study, conclusions and recommendations

6.1 Introduction

This chapter presents a summary of findings and conclusions drawn from the study. It proposes recommendations for action and areas for further study, to improve upon utilization of ICT in education in the WorLD schools and other ICT in education projects in South Africa, in particular, and Africa, in general. The findings and conclusions are generalized to the WorLD study population of learners and educators.

The purpose of this study was to investigate the utilization of ICT in WorLD programme schools in South Africa and to provide strategies aimed at achieving or improving utilization to achieve school ICT educational outcomes and impact (Figure 6.1). The following research questions guided the study:

- How successful was the training provided to teachers and students in WorLD schools (in terms of enabling them to utilize computers for collaborative school projects)?
- What is the literacy level of WorLD school pupils in terms of reading, accessing and using information in the English language?
- To what extent are South African computer teachers able to handle school computer projects, attend to computer systems and attend to their normal school lessons?
- How far does the existing pedagogy in WorLD schools support computer-based teaching?
- What information resources (computer laboratories, Internet, libraries, multimedia centres) exist in the schools and do the schools have media teachers?
- How far can multimedia fill the gap in utilizing ICT in South African WorLD schools?
- What other factors contribute to the success or failure of the WorLD programme in South Africa?

6.2 Summary of findings

This section presents a summary of findings established by this study from the previous five chapters, with respect to the purpose, objectives and the main research questions that guided the study. Insight from the literature is also presented.

6.2.1 From the literature it has been established that:

1. Information and communication technology (ICT) was not only an educational tool but also a driving mechanism for socioeconomic development in a globalizing knowledge economy.
2. ICTs can contribute to improving the quality and delivery of education
3. ICT utilization in education and school networking is not new to schools in South Africa. Nevertheless, a large majority of schools previously excluded have no access to these modern educational tools.
4. ICT in education is new to education administrators, educators and learners in previously excluded schools, especially in the rural areas of South Africa.
5. An organization called SchoolNet South Africa is in place to integrate national ICTs policy in the education system of South Africa.
6. The World Links for development (WorLD) programme is an attempt by the World Bank to provide ICT education for the future generation of developing countries, including South Africa, to enable them to sustain their economies.
7. It is imperative that evaluation studies such as this are conducted to provide information that will guide stakeholders to move to extend access to more schools and improve upon utilization.

After a detailed and an elaborate investigation of the World Links for development programme in South Africa, this study established the following:

6.2.2 Training of educators and learners

1. Educators in the WorLD schools in South Africa have been adequately trained in

computer application programmes and collaborative school projects, but not in database systems and programming.

2. Educators were satisfied with the time allocated to the training and each teacher had a computer to practise skills acquired during training.
3. The study found that technical training of educators was unsatisfactory and no teacher was trained in programming and the UNIX operating system.
4. Lack of training in the UNIX operating system is considered a handicap for the project, because the E-mail system was based on the UNIX operating system.
5. Lack of technical training for educators cast a shadow on the success of the programme, because WorLD computers were predominantly refurbished and required constant maintenance.
6. Lack of technical training prevented the programme from proceeding to the levels of integrating ICTs into the teaching and learning process and schools would have to outsource the technical functions of ICT to private service providers, which have high cost implications for schools in impoverished environments.
7. Many teachers in WorLD schools in South Africa are doing their best to equip themselves, on their own, with IT knowledge and skills. Teachers' enthusiasm and zeal in embarking on private IT tuition bodes well for the WorLD project, in particular, and for ICT utilization in education in South Africa as a whole.
8. Training of learners was found to be unsatisfactory. More than a third of WorLD learners had not been trained at all and close to half of those trained were not trained well enough. Learners spent less time during training than teachers did.
9. No training had been provided to learners in database systems, programming and information skills.
10. Training of learners was unsatisfactory because teachers did not have enough time outside their normal duties to deliver the training, as they had to attend to their normal teaching duties.
11. WorLD learners in South Africa had not acquired sufficient skill and confidence in using ICT during the project pilot phase, as only a limited number had access to a computer to practise after training sessions.

6.2.3 ICT pedagogy in WorLD schools

1. Apart from the project team and research-based teaching methods, WorLD educators in South Africa are not familiar with or trained in, nor do they use, teaching methods that support the utilization of ICT in education.
2. Educators have not been trained in the majority of the required pedagogical methods for the implementation of the WorLD project itself.
3. The existing pedagogy in WorLD schools during the pilot phase (1997-2000) did not support computer-based teaching, for the following reasons:
 - The previous professional training of teachers which did not recognize modern pedagogies.
 - Prevailing in-service training does not integrate ICT into curricula design and training.
 - The lack of cognitive resource-based learning environments, including the non-involvement of media teachers in the integration of ICT into the curriculum.
 - The preponderance of a *chalk and talk* pedagogy found to be prevalent in rural South African schools where this study was conducted and where cognitive education resources, such as libraries and computer laboratories, are lacking.

6.2.4 School Information resources

1. Though a strong correlation exists between the technology and other resources for teaching and learning, recommended as pre-requisites by the resource model (Appendix 1), the majority of WorLD schools in South Africa during the project phase had less than the minimum requirements of the pre-requisite information resources (computer networked laboratories, Internet access, libraries/media centres, media teachers and multimedia centres).
2. The marginalization of the role of the school librarian creates difficulties in the integration of ICTs into the curriculum in schools.
3. The number of functioning computers at WorLD schools and Internet access during

the project made it impossible for effective collaborative projects to take place.

4. Other technology - television, video machines, radio and overhead projectors - which support technology-based education, exists in the majority of the schools.
5. The information resource situation in previously un-resourced rural South African schools, in general, though gradually improving, were not adequate to support ICT education and therefore needed massive improvement.

6.2.5 Teachers' capacity to deliver on WorLD projects

1. There was hardly time for educators to deliver on WorLD projects, even though teachers had acquired the skills and confidence.
2. Project activities affect educators' normal teaching duties negatively, because they were not full-time and dedicated and were engaged in the projects on a voluntary basis.

6.2.6 Literacy effect of the WorLD project on learners

1. The majority of WorLD learners could read, that is access the content from books, and write without assistance.
2. Reading problems were, however, acute where they existed.
3. Only a few learners could access information from the Internet without assistance and just about half of them were able to read from the Internet.
4. Learners' inability to read and access information from the Internet is attributed to the lack of resources at the learners' homes and schools.
5. The use of the local language as a means of instruction and communication also played a significant role in limiting reading and accessing of information from the Internet, which uses the English language.
6. Lack of information skills were identified as the major barrier to the ability of learners to access and use information from the Internet.

6.2.7 Multimedia filling the gaps

Even though many WorLD educators and learners have used a multimedia computer system and are very positive that the tool can assist in ICT education, none of the schools had the minimum ICT requirements to utilise such a system.

6.2.8 Success factors

1. Educators and learners in WorLD schools have been equipped with new skills and modern insights into education.
2. Learners have been equipped with skills which they will utilize in work situations and further education.

6.2.9 Challenge factors

1. The number of functioning computers in a WorLD school is considered a serious limitation to the project.
2. Lack of Internet access, resulting in inability to engage in collaborative projects and inability to integrate ICT into the educational system, meant that the project did not achieve a major outcome.
3. Cost is an issue that seriously impinged on the success and sustainability of the project.
4. The project was found to be an expensive venture and maintaining the computer system may be out of the reach of the schools in the future.

6.3 Conclusions

The conclusions of this study are based on the findings of the study and project outcomes from expectations of the WorLD evaluation research model (Figure 6.1). Achievements and failures, with respect to the expected outcomes and impact of the project, are:

6.3.1 Achievements

The study concludes that the World Links for development programme in South Africa achieved limited outcomes and impact on ICT education in schools during the project pilot phase between 1997 and 2000. This was because educators who were project co-ordinators in the schools did not have time outside their normal working schedules, they did not have the required technical skills to repair frequently non-functional computers, the Internet was not available in the majority of the schools and support from both school administration and the project was minimal. Nevertheless, modern insights into education have been gained and new approaches to education developed in the schools, as well as new challenges. Educators have been provided with additional skills, including the ability to utilise many computer application programs.

Marginal outcomes were recorded in certain areas of the project. International collaboration with peer learners, for example, were developed in the few schools that had Internet access and engaged in collaborative projects. Access to the World's maze of information was available at schools with Internet access. Teachers utilized a few new methods for teaching, at least during the WorLD projects.

6.3.2 Failures

On the whole, however, the project failed to achieve a great proportion of its outcomes and impact (Figure 6.1), which include the following:

6.3.2.1 Learners skilled in computer application systems

This study concludes that South African WorLD learners, the ultimate beneficiaries of the project, had not benefited from the skills acquired by the teachers. This was against the backdrop that 77% of them have never been trained to use a computer and 89% did not have a computer at home. It would be fair to say that less time and effort than required was

devoted to the training of learners by educators for the WorLD project. Learners were not skilled in the computer application systems because educators did not have the time beyond their normal teaching schedules to teach them the systems.

6.3.2.2 Teachers' use of technical skills

It is conclusive from this study that WorLD teachers could not use technical skills effectively because they had not been trained sufficiently and there was no time for them to utilize whatever skills they had acquired through their own training efforts.

6.3.2.3 Teachers' use of Internet resources for education

Though teachers had acquired skills for the use of the Internet they could not utilize the Internet for education purposes because the Internet was often not available. This study therefore concludes that the Internet facility provided during the WorLD project in South Africa was unreliable and did not support the programme during the pilot phase of 1997-2000.

6.3.2.4 Teachers utilize new methods for teaching

The study showed that teachers were not able to effectively utilize new methods for teaching in WorLD schools, because many were not trained in and familiar with the majority of the new methods and there was hardly enough time and Internet access to utilize any new methods that they had acquired.

6.3.2.5 Learners use of Internet resources

South African WorLD learners' use of Internet resources during the project pilot phase was very limited and non-effective. This is because of the lack of training in information skills, the Internet often not being available and educators having little time to teach, guide and supervise learners. This study concurs with the SAIDE Report (1998), that, unless resource

backlogs in schools were addressed, programmes seeking to exploit and implement ICT projects would be marginal or have no effect. Again, it would have been ideal for the project to utilize Internet-based compact discs (CDs) during the project pilot phase, as was done in Uganda, or as is the case with SchoolNet South Africa Educators' Development Network (EDN) CD. The present study argues that the non-involvement of the school media teacher where they existed in the project frustrated the use of the Internet because the use of the Internet is the domain of the school library media teacher.

6.3.2.6 Learners' interactive, collaborative and communication skills developed

This study concludes that South African WorLD learners interacted only to a very minimal degree with other learners across the globe, as was required by the project, and therefore did not benefit fully from collaborative and communication skills, because the Internet was often not available in schools and teachers did not have the time to supervise and assist the learners.

6.3.2.7 Integration of ICT into curriculum

Throughout this study, it has become apparent that one of the most important objectives of the WorLD project, which is to integrate ICT into the curriculum, was not achieved during the project pilot phase. Though the literature has made it abundantly clear that it was the aspect of ICT utilization in education that would take a long time to be achieved, South African WorLD educators and learners believe that the introduction of computer studies as a subject in the schools will help improve ICT integration into the curriculum. It is supposed that the introduction of computer studies will make provision for a full-time (dedicated) teacher and provide capacity in terms of time and personnel for ICT education in start-up schools such as the WorLD schools.

6.3.2.8 Learners engage in collaborative projects

This study showed that learners in the WorLD project were not able to fully utilize ICT for collaborative projects. Data provided by this study indicated that, although the majority of them were involved in at least one collaborative project, only 6% were involved in two projects and as few as 3% in three projects, during the pilot phase. The Internet was often not

available; in any case, to support collaborative projects and teachers did not have the time to help learners in the process.

6.3.2.9 Learners think through school projects and develop knowledge

The literature and available research data has shown that the general school resource and pedagogical situation in WorLD schools did not provide the requisite environment for learners to effectively think through school projects. The study also concludes that the impact of the project on schools has been minimal, given the dire resource situation, as well as the educator capacity situation in which the projects have been carried out, especially the lack of time and technical skills of the teachers. Learners' ability to think through school projects and develop their own knowledge was not introduced by computers. The non-involvement of school librarians, where they existed in the project, is again seen as a setback to the project.

6.3.2.10 Learners' critical thinking skills developed

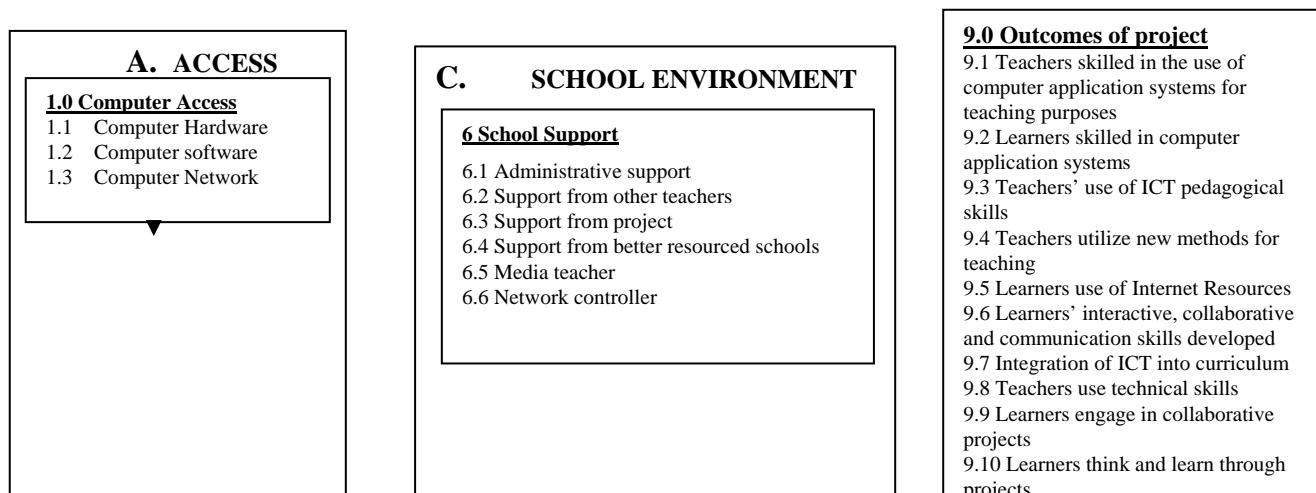
As learners think through their own research projects and use their own acquired information they develop their own knowledge and a critical thinking skills process. This has not been fully developed in this project, in view of the information resource situation in schools and the lack of regular Internet access.

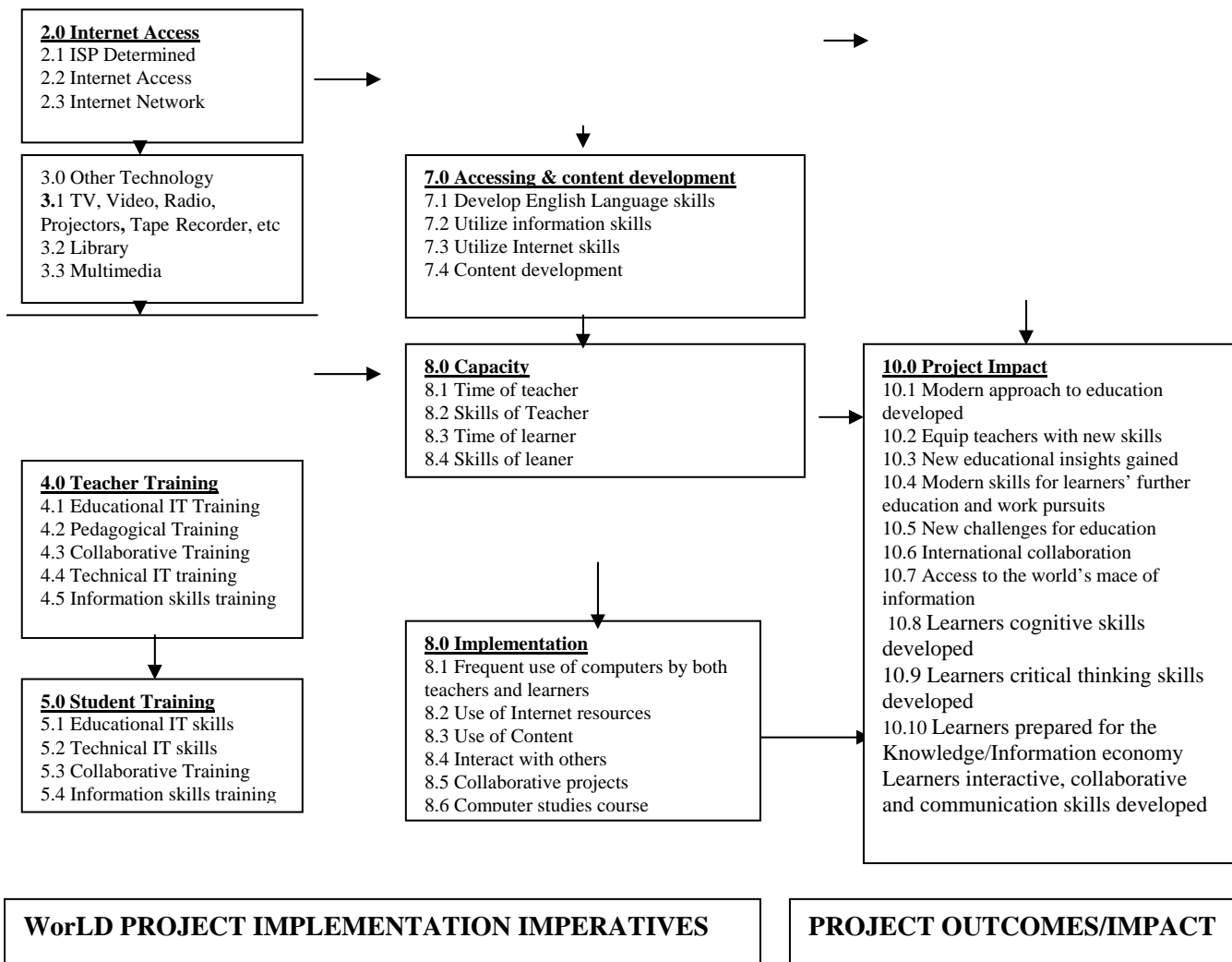
6.3.2.11 Learners prepare for knowledge/information age economy

Ultimately, the aim of the WorLD project was to prepare learners in developing countries to conveniently integrate into the knowledge and information age economy, where prompt access to information or knowledge enables individuals to play worthwhile roles in life. This study concludes that such an aim though very laudable was not achieved because the project did not make adequate provision for the educator and the resource environment. An evaluation model upon which this study was based is presented in Figure 6.1.

Figure 6.1

An Evaluation Model of The WorLD Project in South Africa





This model details an implementation process of the WorLD project hence this study. It begins with the two principal issues that form the core of the study, namely, access to computers and training of educators and learners to utilize ICTs for education. The school environment is an important factor, without which implementation and use of ICTs could not be attained. The model, adapted from the World Bank (McGhee 2000) can be adopted for the evaluation of other ICTs projects not only in South Africa but other African countries.

6.4 Recommendations

The WorLD projects were located in rural South African schools, where the bulk of its population resides, to address the rural-urban ICT education divide and provide useful lessons for a future national roll-out. It has become apparent throughout this study that lessons have been learnt and useful insights gained to guide present and future start-up ICT education projects and processes. The recommendations presented relate to the specific

findings of the study and to a broader policy perspective.

This study recommends that, for an ICT education project to be effective in rural areas in South Africa and the rest of Africa, and to meet its outcomes and make the required impact, the following are crucial:

6.4.1 Training

A national technical ICT strategy for educators must be developed, similar to the SchoolNet South Africa Educators' Development Network (EDN) pedagogical course, being run at the time of writing. Teachers will proceed to an online technical training from the limited face-to-face training they had acquired. It is argued that the limited technical training provided during the WorLD project and what is currently being pursued by SchoolNet South Africa does not provide educators with the knowledge to be able to engage the helpdesk with the right information and confidence to solve hardware and network problems. This situation leads to many school computer laboratories not being able to function to their optimum level, more especially as many schools currently do not have network administrators.

It is recommended that the WorLD project, or the start-up process of any school ICT project in Africa, should make provision for a highly motivated and dedicated ICT teacher, who should be adequately trained in pedagogical, as well as technical skills, to train learners and other teachers on the staff and be able to attain project outcomes in a particular school.

This study recommends that teachers are supported with face to face-to face training in the use of a particular ICT until they are familiar with it, master its use, develop the required confidence and can use it on their own. Taking into account how teachers were trained in the past, it will be difficult to embark on an online training course to master application or technical skills where the rudiments have not been achieved. Nevertheless, this study endorses the new online pedagogy course being provided by SchoolNet South Africa.

Teachers viewed school ICT projects in this study as additional, unremunerated duties. It is therefore important to involve district education officials, school principals, heads of departments, participating teachers and the community in project design and implementation. With such an holistic and inclusive approach schools will be more receptive to ICT use and development, because the education managers in the districts with the communities endorsed the projects. Ntutule & Perold (2001) found that principals who were originally cautious of ICT projects became more co-operative once they knew regional and district managers were involved. With the involvement of school managers and administrators in the planning and implementation of school ICT projects teachers will be able to see the urgency and adjust their time to accommodate the project. They will then not be in danger of losing their jobs. Closely related to this is the recommendation that ICTs in schools must be integrated with the school administration, which requires that the principal and administrative clerk of the school must be trained. Perhaps the model of the WorLD project in Zimbabwe, where project teachers were relieved of all teaching responsibilities and made to manage school tele-centres to serve as school and community information and education centres, could be explored and implemented in South Africa, as well as the rest of Africa.

It is recommended that all persons intending to become teachers should be provided with a pre-service ICT education training in universities and colleges, before they are certified as professional educators. Teachers will be more skilled and confident in a pre-service training environment and it will be less expensive to train them than when they are in service.

6.4.2 The provision of information resources to schools

This study has demonstrated that for a successful ICT education to take place in schools a strong correlation should exist between ICT and other information resources. It is recommended that information resources should not be seen in isolation, but from a holistic perspective. The WorLD information resource model in Appendix 1 must be strictly adhered to. School librarians should be involved in ICT projects at their schools and trained in Internet information retrieval skills, so that they can guide learners with information retrieval and can use library resources to augment their knowledge.

To avoid “dumping”, a national policy on refurbished computers is recommended, to standardise computers donated to schools. Again, the school library and media teacher is a prerequisite, not only to the utilization of ICT in education but, most importantly, for the integration of ICT into the teaching and learning process. As ICT projects cannot take place in schools without the Internet, it is recommended that the cost of Internet access, which is predominantly the cost of a telephone line, be fully explored and discussed with role-players during the project planning phase before the start-up process, to avoid accumulated phone bills and the cessation of Internet access. It is also ideal for school ICT projects to utilize Internet-based compact discs (CDs) during the training phase of projects. Such an approach would not incur Internet costs, but assist in providing the required skills. The current Internet access rate of 50% for schools in South Africa bodes well for school ICT projects and must be examined for other African countries. What is, however, required is that the cost of the telephone helpdesk service be halved, if not eliminated altogether.

6.4.3 Government school ICT policy

Teachers, schools and the entire country of South Africa stand to benefit from a national mission statement on the introduction of ICT to schools. This statement should come from government, along with financial policy support for the use of new technologies and strategic partnerships with industry, the private sector and non-governmental organizations (NGOs). Policy direction is required to strategically incorporate ICT into education and to encourage teachers to use new technologies in their classrooms, nationally and especially in the rural areas of South Africa. A national ICT policy framework for education should aim at:

- Mobilising human and material resources nationally, with incentives for rural schools
- Addressing a holistic school information resource situation, to include school libraries, media teachers and multimedia centres
- Developing human resources among educators in ICT and management skills
- Exploring and deploying appropriate, affordable, but non-specific, ICT for schools in rural South Africa and Africa, including satellite technology in wired, wireless or a combination of wireless and wired network environments.
- Rural infrastructure development, with regards to telecommunication and electricity
- Addressing issues relating to universal access and service in Africa

- Providing pre-service ICT technical and pedagogical training to all teachers
- Determining a model that will integrate the school as a learning centre with a community information resource.

The present study recommends that the South African Department of Education utilises a model which will involve the school community to augment the provision of computers by the WorLD and other projects and be thoroughly discussed during the project-planning phase. Provincial efforts such as “Gauteng online”, of the Gauteng Provincial Department of Education and the Khanya project of the Western Cape Department of Education³⁸, are commended and must be emulated by other provinces.

6.4.4 Integration of ICT into school curriculum

The integration of ICT into the curriculum is a complex and long-term process. It involves the availability of a full-time, well-trained, experienced and motivated educator and the involvement of the school library media teacher. The present work recommends the need to introduce computer studies at all stages of the curriculum and computer science and programming at senior level. They should be examinable subjects so that learners can derive the full benefits of being educated with computers in schools.

The integration programme must create mechanisms and structures to support teacher and learner collaboration after both have mastered sufficient skills. This should be an effort which should create more time for teachers to plan together and train and collaborate in the integration of ICT across disciplines (Ntutule & Perold 2001). Integration of ICTs into the curriculum can only begin if there is less emphasis on the passing of examinations and the pressure of teachers’ work is decreased.

It is recommended that content usage and the integration of ICT into the curriculum should begin with the mastering of applications programmes and the application of information literacy, which should then be followed by questioning skills. The spirit of enquiry, devoid of

38 Information on these initiatives can be found at: <http://www.schoolnet.school.za>

a *chalk and talk* approach to education in African communities, must be inculcated in learners and the learning process. Skills gained from this inquiring approach can be used in specific projects such as collaboratory projects with learners in subjects such as mathematics, English, science and social science.

The idea of integrating ICT into teaching and learning must be conducted in such a manner that educators and learners see mastering of application programmes and learning of specific subjects as one complementing the other. As seen during the WorLD project, learners and educators had regarded themselves as benefiting from computer skills for use in other aspects of life and not for education purposes. ICT in the curriculum must be combined with educators' administration duties in mind. For example, using Excel for designing school and class timetables or mark sheets, which are used by teachers in their day-to-day education activities. It also fosters the holistic approach mentioned earlier.

Care must be taken when recruiting teacher trainers for in-service training, as non-educationists would not be conversant with teachers' roles and would relate training to other uses of ICT, thus missing the holistic approach. A mechanism must be put in place for monitoring the uses to which educators put the skills they had acquired. The tendency to use ICT for other purposes provided grounds and temptation for teachers to leave the classrooms for other services, where their demand is high. In the present study, at least one teacher mentioned pursuing other goals outside teaching, after gaining ICT skills.

The present study recommends that the programme managers educate WorLD school principals on the role of ICT in education, as motivated teachers who see their roles being appreciated by principals will, in turn, encourage their learners. This is critical in school ICT projects, which are considered as added-on jobs, with no extra remuneration. Of course, if these issues are addressed during the project planning stages, such problems will not arise.

6.4.5 Imperatives for the success of the project

It is recommended that a thorough base scan should precede school ICT projects. This should be discussed with schools and followed by a thorough needs analysis of the educators.

Learners should show some signs of cognitive learning skills in a library/media centre before

computers are introduced into the schools. In many instances this was not the case in selected WorLD schools. Media teachers did not, therefore, form part of the project.

Establishing a sense of community, by using electronic mail (e-mail) (asynchronous communication) and “chat rooms” (synchronous communication systems), are essential and considered an important social outcome of ICT implementation programmes in schools. ICT will encourage both educators and learners unconsciously to learn skills fast. Care should, however, be taken to provide guidance on issues of interest concerning communication, to foster focus-group discussions.

It is recommended that steps be taken to consolidate project outcomes and successes prior to expansion in subjects or to the community. Issues such as the following are crucial:

- The adequacy of ICT infrastructure at the school
- Technical support from the school and from outside sources
- School management support
- Consolidated and continuous training
- Practising of new skills
- Motivation of participants

6.5 Recommendations for further studies

The focus of this study has been the monitoring and evaluation components of the WorLD programme. Determining the success or failure of a project and hence value for money is crucial to that project. It is therefore recommended that the evaluation model proposed by this study be tested to prove its efficacy, with regards to evaluating ICT education projects being sponsored by schools, communities, funders and governments.

It is also recommended that, with the advancement of technology and the emergence of nascent ICT products that could foster more affordable and sustainable computer access and connectivity, research be conducted into the use of new technologies such as wireless,

satellite and open-source software in schools in South Africa and in the rural areas in general.

It was indicated in the literature review for this study that one of the most formidable challenges to the use of ICTs in developing countries, especially in Africa, was the challenge of ownership of knowledge and knowledge products. This study recommends that research be conducted to establish the extent to which Africans are being alienated from their way of life or otherwise because of their lack of control of the knowledge systems and products that are being used in the name of globalisation and a knowledge economy. Perhaps the question to investigate is, to what extent are African communities, and particularly those in South Africa, thinking global and acting local?

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