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CHILDREN'S ACQUISITION OF COMPUTER LITERACY SKILLS IN THE MAMELODI DIGITAL DOORWAY PROJECT

by

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DECLARATION

I, Mmankoko Ziphorah Morolo hereby declare that the work on which this dissertation is based, is original (except where acknowledgements indicate otherwise) and that neither the whole work or any part of it has been, is being, or is to be submitted for another degree at this or any other university or tertiary education, institution or examining body.

MOROLO M.Z

Signature:…… Date:……..

DEDICATION

TO:

Johannes, my husband

Phenyo and Oarabile my beloved children

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SUMMARY

Children's acquisition of computer literacy skills at the Mamelodi Digital Doorway project

Many South Africans have never interacted with a computer before and the majority of children are growing up in an environment characterized by low levels of computer literacy. Today, Information Communication Technology (ICT) and basic computer skills are pre-requisites in all professional and many semi-skilled jobs and are becoming increasingly important to basic survival in the world. The Digital Doorway initiative is aimed at better understanding and addressing the computer literacy needs of users within South Africa and Africa (Smith et al., n.d).

A project called Minimally Invasive Education was recently established in India by professor Sugata Mitra of NIIT. In this project, experiments called "Hole-in-the-Wall" were conducted where Pentium computers connected to the Internet were provided on the roadside and turned on without any instructions or announcement. Mitra was interested in observing the behaviors of people in a technologically disadvantaged area when exposed to a computer. He observed that users generated their own terms for a number of commonplace computer terms. He also observed that despite never having interacted with a computer before, children were very quick to master basic computer skills. In these experiments, Mitra tested his hypothesis that: the acquisition of basic computer skills by any set of children can be achieved through incidental learning, provided the learners are given access to a suitable computer facility, with entertaining and motivating content and some minimal (human) guidance (Mitra 2001).

Based on the success of the “Hole-in-the-Wall” experiments in India, a similar project was started in South Africa by the Council for Scientific and Industrial Research (CSIR) and the Department of Science and Technology (DST). The project adopted the name “Digital Doorway” and the first site was launched in the rural community of Cwili, in the Eastern Cape in December 2002. A second site was established in Mamelodi an urban township north of Pretoria in the Gauteng province in June 2004.

The Digital Doorway project set out to confirm that children and adults could teach themselves how to master basic computer sills, merely by having free access to a computer and being allowed to explore and try out things on their own, without formal training.

KEYWORDS

- Acquisition of computer literacy skills
- Mmamelodi Digital Doorway project
- Minimally Invasive Education
- Indian “Hole-in-the-Wall” experiments
- Incidental learning
- Internet
- Kiosk
- Information Communication Technology
- Council of Scientific and Industrial Research
- Department of Science and Technology
- Net Generation

LIST OF ABBREVIATIONS

CSIR	Council for Scientific and Industrial Research
DST	Department of Science and Technology
MIE	Minimally Invasive Education
NIIT	National Institute for Information Technology
CRCS	Centre for Research in Cognitive Systems
IGNOU	Indira Gandhi National Open University
LEDA	Learning through Exploration, Discovery and Adventure
OBE	Outcomes-Based Education
GUI	Graphic User Interface

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CHAPTER 1: INTRODUCTORY ORIENTATION

1.1 Introduction

> *The acquisition of basic computing skills by any set of children can be achieved through incidental learning provided the learners are given access to a suitable computing facility, with entertaining and motivating content and some minimal (human) guidance (Mitra 2001:1).*

According to Dix (2003:4) computer literacy need no longer be a privilege of people who are educated and can afford computer at home or their work place. Children were found to be the prime users of street Internet kiosks. They learn to operate as well as play with the computer with minimum intervention. They pick up skills and tasks by constructing their own language environment. Perhaps this is the learning paradigm of the age.

The Council for Scientific and Industrial Research (CSIR), in collaboration with the Department of Science and Technology (DST), has launched a project to evaluate the feasibility of alternative computer training methods. Their project is known as the Digital Doorway. Within the broader scope of the CSIR's project, this research study endeavours to explore whether children from the Mamelodi urban area are capable of obtaining basic computer skills without the guidance of facilitators.

The main aim of this chapter is to outline the background information to the concept of Minimally Invasive Education (MIE) with reference to the Indian "Hole-in-the-Wall" experiments and South African "Digital Doorway" projects.

1.2 Minimally Invasive Education

It is important to define the term Minimally Invasive Education (MIE) in context before we consider factors or elements of the process of Minimally Invasive Education (MIE). Minimally Invasive Education is a pedagogic method and derives its name partly from the medical term "minimally invasive surgery". Inamdar (2004:337) defines Minimally Invasive Education as:

> *A pedagogic method that uses the learning environment to generate an adequate level of motivation to induce learning in groups of children, with minimal, or no intervention by a teacher.*

The concept of Minimally Invasive Education (MIE) was pioneered by Professor Sugata Mitra of the NIIT Center for Research in Cognitive Systems (CRCS) in India. According to Mitra (2001:1) MIE is based on the belief that the acquisition of basic computing skills by any set of children can be achieved through incidental learning, provided the learners are given access to a suitable computing facility, with entertaining and motivating content, and some minimal human guidance. Mitra believes that children, even terribly poor ones with little education, can quickly teach themselves the rudiments of computer literacy: he therefore calls the concept ”Minimally Invasive Education”.

The idea of MIE has crystallised over a period of time based on observations and educational experiments. Mitra launched the “Hole-in-the-Wall” experiment to test his hypothesis.

To access the skill levels of the users, Mitra and Rana (2001:223) point out that the Indian team defines a computer literate person as one who can:

- turn a PC on;
- use MS Paint to create a designated picture;
- move objects using folders, shortcuts, cut-and-paste, drag and drop, copy and delete methods;
- move from one web page to another and back;
- send and receive e-mail through a PC that is pre-configured to do so.

For the purpose of this chapter, the Kalkaji experiment (Indian “Whole-in-the-Wall”), the Cwili Digital Doorway project (South Africa) and the Mamelodi Digital Doorway project (South Africa) will be discussed.

1.2.1 Experiments with MIE in the Indian “Hole-in-the-Wall” Experiment

Earlier work often referred to as the “Hole-in-the-Wall” experiments has shown that groups of children can learn to use public computers on their own. The press labelled these experiments, first conducted in 1999, “Hole-in-the-Wall” experiments, because the experiments consisted of computers built into openings in brick walls in public set ups. The experiment was conducted in 23 locations in India (Inamdar 2004:1).

According to a CSIR report, the experiment was conducted in two Indian-speaking areas in India (Kalkaji and Udang). There was no prior consultation with the community members regarding the project. A pentium computer (PC), with only English content, a monitor and the touch-pad, Windows program and Internet access was merely placed in an area so that people in and around that area (which consists of mostly slums) could explore and experiment at their own convenience (http://www.csir.co.za).

In two experiments conducted in India, personal computers connected to the Internet were provided on the roadside and turned on without any instructions or announcement. In both instances it was found that the acquisition of basic computing skills by groups of children was achieved through incidental learning and some minimal (human) guidance (Mitra 2000:1).

1.2.1.1 The Kalkaji experiment

The experiment was first conducted in Kalkaji, a suburb of New Delhi, India, where a computer was connected to the Internet and embedded into a brick wall near a slum. The kiosk was made operational on 26 January 1999. Figure 1.1 illustrates the Kalkaji experiment (Mitra & Rana 2001).

Figure 1.1: The Kalkaji experiment

According to Business Week (BW) online editor Peterson (2002:76), Mitra tested his ideas by taking a personal computer and connecting it to a high-speed data connection and imbedding it in a concrete wall next to NIIT's headquarters in the South end of New Delhi. The wall separates the company's grounds from a garbage-strewn empty lot used by the poor as a public bathroom. Mitra simply left the computer connected to the Internet and allowed any passerby to play with it. He monitored activity on the personal computer using a remote computer and a video camera mounted in a nearby tree. According to Mitra and Rana (2001:224), activities were monitored through the day and notes were taken.

The Kalkaji kiosk continued to be operational in February 2000 and about eight children used it. According to Mitra and Rana (2001:230), the experiment was conducted to find out whether:

- potential users will use a personal computer-based outdoor Internet kiosk in India without any instruction;
- a personal computer-based Internet kiosk can operate without supervision in an outdoor location in India.

Mitra and Rana (2001:226) observed that children were the first users and they were able to start browsing within the first four hours of use. The kiosk was turned on with www.altavista.com as the home site and "no instruction" was the key instruction. At that stage keyboard access was not given. The only instruction (not given deliberately) was the final testing of the system with the "touch pad" – the pointing device provided.

In their further observation Mitra and Rana (2001:226) discovered that among the first users were the little boys from the colony aged 6 to12 years. The initial response to the system was to generally fiddle around with the touch pad, and since the pointer moves with it, they found it interesting. The next thing that they learned incidentally was to "click" from the touch pad itself. Later they came to know what exactly is "clickable" on the screen as the pointer changes from an arrow to a hand shape when it is on some link. The next thing they could relate to their knowledge was the "channels" icon on the browser.

According to Inamdar (2004:338), children were able to learn to use computers and the Internet on their own, irrespective of their social, cultural or economic backgrounds. Within days, the children had taught themselves to draw on the computer, create documents and paint pictures and to browse games on the Net. Some of the other things they learned were astonishing (Inamdar 2004:338). Soon, children were downloading their Hindi music and learned how to use Microsoft Paint.

Peterson (2002:76) observed that the most avid users of the machine were ghetto children aged 6 to 12, most of whom had only the most rudimentary education and little knowledge of English. Despite their limited understanding of English, they were able to teach themselves the basic operations and even invent their own computer jargon. Priya, Charles and Gunjan (2002:36) proved this when they highlighted that children made up their own computer terminology, calling the cursor a "sui" (Hindi term for needle) and the hourglass a "damru" (the Hindi hourglass-shaped drum). Some had even amassed a small vocabulary for English words such as "open", "save" and "file" though they might mispronounce them and understand the words only in the context of computer.

On the fourth day as reported by Mitra and Rana (2001:228) it was found that one of the slum dwellers Sanjay Chowdhary (a BA 2nd year student from the Correspondence College of the University of Delhi) was computer literate. He had done a basic course on computers from IGNOU (The Indira Gandhi National Open University). Since he was the only one who knew computers in the colony, all children treated him with great respect. He was found teaching them how to operate the touch pad (the pointing device). The most visited sites were disneyblast.com, MTVonline, and the "Paint" application.

The observation further indicated that those underprivileged children, without any planned instructional intervention, achieved a certain level of computer literacy. They were able to self-instruct and obtained help from the environment when required. In Mitra and Rana's (2001:230) opinion, this is common phenomenon among urban children. None of the adults or parents of these children seemed to have made any effort to use the personal computer. Moreover, very few girls were seen using the personal computer.

1.2.1.2 The Udang experiment

The second experiment was conducted as a set course for children in NIIT Limited, an Indian training company with over 150,000 students. These experiments were called Learning through Exploration, Discovery and Adventure (LEDA) and were based on a publication (Ahuja et al., 1995 in Mitra & Rana 2001:223).

The structured use of computer games to meet learning objectives was the key strategy. Once again, it was observed over a period of four years that skill training would happen automatically in children given enough access and motivating content.

Given the results and importance of such experiments (Hole-in-the-Wall) as one of the best, cheapest and most innovative methods of meeting the technological needs of developing countries and providing people with access to information, the CSIR together with the Department of Science and Technology (DST) believes South Africa will have similar success in employing a minimally invasive approach to technology literacy. It was therefore decided to replicate the experiment in South Africa taking into consideration the different demographic, social and cultural issues unique to this country as compared to India.

1.2.2 South African "Digital Doorway" Projects

Today Information Technology (IT) and basic computer skills are pre-requisites in all professional and many semi-skilled jobs and are becoming increasingly important to basic survival in the world. "Many South Africans have never interacted with a computer before and the majority of children are growing up in a computer literate environment"

(Gush et al., n.d). The CSIR in collaboration with the DST has realised the importance of computer literacy as of paramount importance to development in today's world.

The CSIR and the DST launched the Digital Doorway project in South Africa. The Digital Doorway project follows an extreme constructivist approach called Minimally Invasive Education. The CSIR and the DST embrace this concept of Minimally Invasive Education to provide an opportunity for the vast majority of people from the disadvantaged backgrounds and developing areas in South Africa to become computer literate (CSIR 2004). The aim of the Digital Doorway project is to:

> *…ascertain whether people possess the cognitive ability to obtain computer skills without being formally trained (Smith et al., n.d).*

The Digital Doorway project can be regarded as a paradigm shift in education. The Department of Education (2003) refers to a paradigm shift as:

- a complete new approach on matters that you believe in;
- a new game with new rules;
- a change in your beliefs about teaching practises, learning, learners and school management.

1.2.2.1 Rationale behind the Digital Doorway Project

The CSIR regards the Digital Doorway Project as one of the best, cheapest and most innovative methods of meeting the technological needs of developing countries and providing people with access to information in order to bridge the digital divide (Smith et al., n.d.). According to Gush (2004) the idea is to provide people in rural and disadvantaged areas with computer equipment and allow them to experiment and learn with minimal external input. The Digital Doorway project set out to confirm that children and adults could teach themselves how to master basic computer skills, merely by having free access to a computer and by being allowed to explore and try out things on their own, without formal training.

Smith et al (n.d) list the objectives of the Digital Doorway project as follows:

- to test the feasibility of minimally invasive education as an alternative mechanism for large-scale computer literacy in South Africa;
- to determine the efficiency of the Digital Doorway concept as a delivery mechanism for PC literacy as well as information and service delivery in South Africa;
- to determine whether potential users in a rural community in South Africa will use a PC-based outdoor kiosk without any instruction;
- to determine whether a PC-based kiosk can operate without supervision in an outdoor location in South Africa;
- to provide a platform for the evaluation of appropriate technology solutions, open source, applications an human language technology;
- to determine salient issues such as:
    1. Effectiveness of applications installed on kiosk.
    2. Effectiveness of logging and observation mechanisms.
    3. Benefits of technology as deployed.
    4. Sustainability.
    5. Effectiveness in attracting women.
- to use the infrastructure established as a test for culturally sensitive computing, human computer interface and the role of human language in computer interaction.

The Digital Doorway computer terminals house regular word processing software for typing letters or messages, and carry mathematics, science, music and language applications, an HIV/Aids presentation, Internet and e-mail access, and entry-level versions of Word and Excel. They are configured to stimulate actual computer usage conditions, and include multimedia capabilities to ensure an enriching learning experience for users (http://www.southafrica.info/ess_info/sa_glance/education/digitaldoorway.htm).

The hardware consists of an outside terminal embedded in a steel housing. The terminal is served by an LCD screen, vandal-proof keyboard and touchpad. A server is also located inside the steel housing. The server is used for video capture. Internet

connectivity is provided by various mean, e.g. GPRS (http://www.digitaldoorway.org.za/index_main.php?do=hardware). Figure 1.2 illustrates the blue metal machine.

Figure 1.2: The blue metal machine

1.2.2.2 The first Digital Doorway installation

The first Digital Doorway, a freestanding multimedia computer terminal with a keyboard and touchpad embedded in a robust kiosk accessible to the public 24 hours a day, was launched in Cwili village near Kei Mouth in the Eastern Cape's Libode district in 2002 (http://www.southafica.info/ess_info/sa_glance/education/digitaldoorway.htm).

The selection of Cwili was based on a recommendation by DST and informed by the fact that the Minister of Science and Technology has taken a personal interest in the area after a visit the previous year (Smith et al., n.d.). Figure 1.3 illustrates the exact location of Cwili.

Figure 1.3: Location of Cwili in the Eastern Cape

- **Community Background**

Set on two windswept hilltops above the Kei River mouth in South Africa's Eastern Cape Province, Cwili is a rural community of 2,600 people, with a chaotic jumble of colourfully painted shacks and breezeblock houses, surrounded by informal piggeries, free-roaming chickens and vegetable gardens. Unemployment is a serious problem with the main sources of income being subsistence farming and domestic work during the holiday seasons. There is a high illiteracy rate in the township with Xhosa being the main language. The village is under developed socially, economically and technologically (http://www.sundaytimes.co.za).

Before the installation of the Digital Doorway, there was no home computer in the village. The local primary school had six computers but only one of these was operational. This computer was in the principal's office and used by himself and the technology teacher for their own computer literacy purposes, for very basic administrative purposes, and for typing examination papers, which had to be printed elsewhere as the school does not have a printer (Philp 2003:1).

According to Philp (2003:1), the mysterious steel-sided kiosk became the first computer ever in Cwili. Only four young adults in the community were able to use a computer for straightforward activities, such as at best, being able to write a letter. The schools

reported no computer literacy among their learners. Cwili Township revealed a great interest in computers but the level of computer awareness was very low; most inhabitants did not know what a computer could do or had to offer them.

- **Location and construction of the outdoor kiosk**

The kiosk was installed in November 2002. Because the aim was to make the kiosk easily accessible and available 24 hours per day, the decision was taken to locate the kiosk on the veranda of the community hall which is the first building situated on the main road used by people coming in and out of the village. The hall is next to a clinic and a crèche, and is used by the community for meetings, social occasions, club gatherings and a small sewing project. An office inside the building was made available to house the file server. The kiosk is protected from rain and township dust by a fiberglass sheet (http://www.digitaldoorway.org.za/news/news.htm#dec2002).

In Cwili, a kiosk was placed in the community hall after obtaining permission from community heads and leaders to provide access to various applications, including Internet. The computer had logging software for monitoring and evaluating usage, as well as closed circuit camera to record the behaviours of the Cwili inhabitants. Figure 1.4 illustrates the Cwili Digital Doorway (http://www.senorjosh.com/archives/2003/12/digital_doorway.shtml).

Figure 1.4: Cwili Digital Doorway

- **Results of the first Digital Doorway installation**

Smith et al. (n.d.) reported that the children were mastering basic computer skills at a tremendous speed and that they were capable of using the computer with confidence within days after the initial installation. Observation and interviews conducted with villagers of Cwili indicated that:

> *…both children and young adults have moved from an initial state of computer illiteracy to a state where the computer is approached with great confidence and an awareness of some of its exciting multiple uses (Smith et al., n.d.).*

The Cwili Digital Doorway is used from as early as 5 a.m. until approximately 9.30 p.m. Groups of 6 to 10 children, both boys and girls, aged between 9 and 15, regularly use the computer. The most popular programs for the Cwili children are the educational programs as well as the music programme, while the older groups prefer the Internet and Word, as well as the music (http://www.southarica.info/ess_info/sa_glance/education/digitaldoorway.htm).

Within a month of installation, about 60% of the village children had already taught one another basic computer functions, including the ability to drag icons, re-arrange windows and open applications (See figure 1.5). A number of young adults, mainly males, also use the Cwili kiosk, though they prefer using it in the evenings “after work” when there are fewer people around and “the children have finished playing” (http://www.southafrica.info/ess_info/sa_glance/education/digitaldoorway.htm).

Professor Russell professor emeritus of adult education at the University of Witwatersrand who was contracted to evaluate the Digital Doorway installation in Cwili, reported that typical responses from youths and young adults when asked what use they would make of a computer set in the township for them to use freely were (http://www.southarica.info/ess_info/sa_glance/education/digitaldoorway.htm),:

> “*The computer will help me get a job.”*
> *“I have seen computer but I don’t know about them.”*
> *“I like to use a computer but someone must show me how.”*
> *“Computers are on TV.”*
> *“Where is the computer? Show me how to use it.”*

"I know computers. Will they help me understand?"
"When it comes here, I will use it."
"Please tell me what computers do."

The results obtained from the Digital Doorway in Cwili could therefore be compared with the observations made by Dr Mitra during his "Hole-in-the-Wall" experiment. This is confirmed by Sebesho (2003 in Dix 2003:5), a project co-coordinator for the council when saying, "A similar experiment in India had shown that children had a fantastic ability to teach basic computer literacy to themselves and each when formal teachers were not available". Sebesho further added that, "in terms of interest and speed with learning the functions", Cwili's children were already two to three months ahead of their Indian counterparts.

Based on the success and interest of this project in the first Digital Doorway site, the DST, CSIR and MTN launched a second urban pilot study in Mamelodi, east of Pretoria in the Gauteng Province. The project was named the 'Mamelodi Digital Doorway'.

1.2.2.3 The second Digital Doorway installation

The second Digital Doorway kiosk was installed in Mamelodi, the vast township to the east of Pretoria, South Africa.

On Wednesday, 30 June 2004, the Minister of Science and Technology, Mr. Mosibudi Mangena launched the Digital Doorway installation in Mamelodi. It is the first installation in Gauteng and only the second one in South Africa. "Residents of Mamelodi now have the opportunity to reap benefits from science and technology by becoming more technologically literate through teaching themselves computer skills" (http://www.csir.co.za/plsql/pTl0002/PTL0002_PGE013_MEDIA_REL?MEDIA_RELEASE_NO=7194503).

- **Location of the Mamelodi Digital Doorway**

The Mamelodi Digital Doorway is located off a busy main street of the township's Central Business District (CBD) near the Mamelodi multi-purpose community centre, providing an urban contrast to the first site location in the remote rural Cwili Village (http://www.southafrica.info/ess_info/sa_glance/education/digitaldoorway.htm).

The kiosk is situated next to the busy road that is used to enter the township. There are always people at the kiosk as well as merchants who are selling food next to the room. It is a safe venue with many people passing by. Figure 1.5 shows the Mamelodi Digital Doorway kiosk from the outside (Gush, et al., n.d.).

Figure 1.5: The Mamelodi Digital Doorway kiosk from the outside

- **Physical framework of the Mamelodi Digital Doorway**

The following is a detailed description of the physical framework of this project as provided by the CSIR (http://www.csir.co.za).

- **Inside the kiosk**

The computer is situated in a corner of the room. It is fixed to the wall and cannot be removed. All the components such as the screen, the keyboard and the computer form a single unit with the stand. The height of the screen is approximately 1, 2 m from the ground. There is a footstool for smaller children who cannot reach the screen and the keyboard. A video camera was placed in the room to record the people around the computer. Figure 1.6 shows inside the Mamelodi Digital Doorway kiosk (Goldstuck 2004:2).

Figure 1.6: Inside the Mamelodi Digital Doorway kiosk

- **Observation of the Mamelodi Digital Doorway installation**

The following is an excerpt from an article written by Intelligence Total Business reporter, Arthur Goldstuck (2004:12-13) after observation to Mamelodi Digital Doorway:

> *One of the men stands on a blue metal platform in front of what looks like an automatic teller machine (ATM). He punches the buttons with gusto, and the men around him urge him on enthusiastically. Suddenly, music bursts from the screen and everyone cheers. The crowd jostles continually until the man on the platform gives up his spot and the next guy takes his turn, gingerly feeling his way around a computer keyboard and screen, under a sign that declares: Digital Doorway.*
>
> *The young men crowded around the machine on a cold winter morning are merely the first "shift". As the day wears on, the crowd does not grow, but its makeup changes. The way it is used also changes, depending on who takes their place on the platform.*
>
> *Later in the morning and that afternoon, children hold sway. Games, educational material and movies fill the screen. More boys than girls risk the leap into the digital world. Later in the evening, it is again mostly men. Some find information on electricity use and Aids prevention. Some play games. One creates a Curriculum Vita (CV) and saves it into a website. A petrol attendant experiments with creating artwork*.

1.3 Motivation and Rationale

The CSIR contacted Professor S. Blignaut, professor in Curriculum Studies at the University of Pretoria, where Ronel Smith (project organiser) outlined the details of the Indian-Hole-in-the-Wall experiments. She requested help from the students to research on this project. As I was fascinated by this project, I became one of the researchers.

What interested me mostly about the project was that learning occurred without the guidance of facilitators. I decided that I would like to do research to explore whether children were really capable of learning how to use the computer without the guidance of a facilitator and to what extent and in which way learning had taken place.

The researcher's interest in technology literacy has always been motivated by the demands on educational change, that is, a new paradigm that goes beyond traditional practise. This paradigm includes creative and critical thinking, communication skills, and the ability to find information as well as the ability to interact with others. Outcomes-based education (OBE) is the education approach, but it cannot succeed unless children are computer literate and have access to the Internet.

Research in this field of study will help us to identify problems and challenges, to identify the possible learning, and most importantly determine whether the process can and will succeed in South Africa. In this case the views, opinions and experiences of people who are directly involved are very important and vital to ensure the success of the project.

It is from this perspective that this study aims at determining how children in the Mamelodi Digital Doorway project acquire functional computer literacy skills using their own intuition and exploration.

1.4 Statement of the problem and research question

The setting in Mamelodi is different from other related projects because Mamelodi is an urban township. Computers are sometimes available to some people, that is, some of the people are computer literate and have access to a computer either at home or at

school; and some of the people are not computer literate and they have no access to computers.

The acquisition of computer literacy skills without formal training is not easy. As a form of learning, it needs co-operation and collaboration from other participants. There are challenges, problems and difficulties involved in the acquisition of computer literacy skills. In all the learning stations, namely the Indian “Hole-in-the-Wall” project, Cwili Digital Doorway and the Mamelodi Digital Doorway projects, common problems are experienced. One of the major problems experienced is that the computer is left without any instructor; therefore it is hard for those that do not have computer skills to operate it.

In view of the above, the following research question arises when talking about the acquisition of computer literacy skills without formal training:

How do children acquire computer literacy skills using their own intuition and explorations?

In determining whether children are capable of acquiring computer literacy skills successfully it will be necessary to answer the following four critical questions that were identified:

- To what extent had children acquired computer literacy skills through the launching of the Digital Doorway project in Mamelodi?
- How did these children acquire computer literacy skills without the guidance of a facilitator?
- What is the computer jargon acquired and which computer applications do they use?
- What is the value of the social interaction between children?

1.5 Aim and objectives of the study

Taking the problem statement and the research question into consideration, the following aim and objectives emerged:

The central aim of this study is:

To investigate how children at the Mamelodi Digital Doorway project acquire computer literacy skills with minimal guidance.

Therefore the objectives of this study are:

- To determine what the literature has to say about the independent use of computers in a similar learning station.
- To observe the behaviors of the participants using the Mamelodi Digital Doorway project.
- To interview the participants using the Mamelodi Digital Doorway project.

1.6 Methodology

The methodology to be applied in this study will specifically be based on literature study and qualitative research.

1.6.1 Literature study

In order to explore the understandings and experiences of children with regard to the interaction and participation at the Mamelodi Digital Doorway project, both primary and secondary sources of information will be used. Children will be interviewed and observed; information from journals reporting on the Indian's "Hole-in-the-Wall" experiments as well as the results found in Cwili Digital Doorway project will be made use of.

Reference books, articles and other informative studies have been reviewed and consulted to get relevant information on the topic. Bell (1993:33) states that "any investigation, whatever the scale, will involve reading what other people have written about your area of interest, gathering information to support or refute your arguments and writing about your findings". Bless and Higson-Smith (1995:22) define literature review as "a process of reading some background information that has been published and appears to be relevant to the research topic".

The issue of Minimally Invasive Education was developed in India by Professor Sugata Mitra and copied by the CSIR in South Africa. Professor Mitra has written and published materials on the process of learning in the “Hole-in-the-Wall” experiments. In South Africa, a written report was captured from the Cwili Digital Doorway project. Different theories from various authors in the field were analysed and interpreted.

1.6.2 Qualitative research

It has already been mentioned that the central aim of this study is to investigate how children at the Mamelodi Digital Doorway project acquire functional computer literacy skills with minimal guidance; therefore**,** the aim of the investigation justifies a qualitative approach, namely observing the videotapes and interviewing participants.

1.6.2.1 Why qualitative research?

The research method used here, as will be explained further in Chapter 3, is a qualitative one. The researcher chose to use qualitative research because Grove (1993:65) says: “I wanted to describe experiences as they are lived”. In other words, the researcher wants to understand the subjects of her research from their own point of view. The intent of this research is, as Mertens (1998:169) mentions, “to understand and describe an event from the point of view of the participant”. Thus, the researcher regards qualitative research, which approaches respondents with the intent of understanding their point of view, as the research that least distorts the respondent’s experiences.

- **Population and sample**

The study population consists of children in Mamelodi, an urban township in Pretoria, Gauteng Province. Thirteen (13) children who frequently use the Digital Doorway project were interviewed. Purposive sampling is used because the aim of the search for information in a qualitative study is not to gather information from vast numbers of people but to examine information from informed and representative people in the study population (McMillan & Schumacher 2001:175). Lawrence-Newman (1997:419) says, in qualitative research, “Adequacy refers to the amount of data collected, rather than to the number of subjects as in quantitative research”.

The researcher employed purposive sampling, which according to Merriam (1988:48) is based on the assumption that I wanted to discover, understand, and gain insight. The researcher needed to select a sample from which she could learn the most. In addition to written documents, the researcher also conducted two semi-structured interviews as a means of comparison, which provided this study with additional rich data.

1.6.2.2 Data collection strategies

Data collection is a detailed description of the data gathering procedures for the planned investigation. This description covers the specific techniques to be employed, specific measuring instruments to be conducted in making the measurement (De Vos, 1998:100).

A tape recorder was used as an Aide-Memoir or helpful record of the conversation for later analysis. A tape recorder allows the researcher to concentrate on what is said rather than taking the notes. Tape recording also allows the researcher to keep a full record of the interview without being distracted by detailed note keeping (Bianche & Durrnheim 1999 in Mothemane 2003).

Different methods of data collection techniques were employed to gather relevant information for the study. More than one method gives the researcher the opportunity to get information from individuals and verify it by means of another method. The data collected from children during interviews could be verified and confirmed through literature study. The following are methods employed to gather and acquire information or data needed for my study:

1 Observations.
2 Interviews.

- **Observations**

Marshall and Rossman (1999:107) define observation as “a systematic noting and recording of events, behaviours and objects in a social setting chosen for the study”. They emphasise that observational records that are called field notes are detailed, non-judgmental and are concrete descriptions of what has been observed. They further

emphasise that observation is a fundamental and highly important method in all qualitative inquiry. It is used to discover complex interactions in natural social settings. Even in in-depth interview studies, observation plays an important role as the researcher notes the interviewee's body language in addiction to his/her words.

This method is important and necessary because the researcher experiences the real life situations through observing children interacting with the computer. One gets an overview of the practical situation in the kiosk in terms of communication, co-operation and social interaction among children.

- **Interviews**

This method is employed to describe the practical situation at the Mameloldi Digital Doorway project and to get first-hand information from children.

An interview is a method of gathering information that involves direct personal contact with the participant who is asked to answer questions (Bless & Higson, 1995:106). Marshall and Rossman (1999:109) define interview as "a conversation with a purpose, it is a useful way of getting large amounts of data quickly".

Cates (1985:97) identified few advantages and disadvantages of interviews. He mentions that "the major advantage of individual interview is that the interviewer can tailor it to the person being interviewed and can utilize both verbal and non-verbal cues in determining the responses".

He also mentions "its major disadvantage is that data gathering through interviews may be unreliable or inconsistent because of difference in questions or methods employed by the interviewer or because of differing levels of perceptiveness and effectiveness among interviewers".

On the other hand, it is said that there is always the danger of bias in interviews, largely because interviewers are human beings and not machines, and their manner may have an effect on the respondents (Bell, 1993:95).

Semi-structured interviews are employed in this study. This type of interview is easy to use as the researcher can decide on the order and wording of the question even though she has prepared the questions beforehand. The researcher can also decide whether follow-up questions should be asked. Grinnel and Williams (1990:215) emphasise the fact that “this type of interview is often used when the study is at the descriptive level”.

1.6.2.3 Data analysis and interpretation

According to De Vos (1998:100) and Maykut and Morehouse (1994:127), data analysis is the process through which one understands more about the phenomenon under investigation and describes what one has learnt with a minimum of interpretation. It simply explains the procedure that one will use to analyse data. Whereas Jorgenson (1989:107) states “analysis of data is the breaking-up, separating, or disassembling of research materials into pieces, parts, elements or units”. According to him when facts are broken down into manageable pieces, the researcher is able to sort and sift them, searching for types, classes, sequences, processes, patterns or wholes. He adds by stating, “The main aim of the data analysis process is to assemble or reconstruct the data in a meaningful or comprehensible fashion”.

1.7 Limitations of the study

Little or no research has been done on the Mamelodi Digital Doorway project. There is no evidence of research that has been done on the Mamelodi Digital Doorway project in South Africa. The only comparable research available in South Africa was done in Cwili in the Eastern Cape Province.

The limitations of the study that were identified at the onset of the research project were:

- Research conducted will be limited to a specific developing area in South Africa, namely Mamelodi.
- The site was never visited to question the participant; this is why the study will report on the perceptions of the children using the Mamelodi Digital Doorway.
- Research findings are limited to the South African context.
- A small sample group will be used.

- Research will only concentrate on the acquisition of computer literacy skills without human guidance.

1.8 Clarification of terms

The researcher decided to explain to the reader the meaning of a number of concepts and terms that are important for the purpose of this research.

1.8.1 Minimally Invasive Education (MIE)

Minimally Invasive Education (MIE) is the term used by Mitra (2000) to describe the teaching method used in the “Hole-in-the-Wall” experiment. It refers to an educational method where people teach themselves with minimal or no guidance.

1.8.2 “Hole-in-the-Wall” experiments

The “Hole-in-the-Wall” experiments refer to experiments conducted by Mitra (2000) in India. A computer was placed in a hole in a slum area of India. The community was given free access to the computer to teach themselves computer skills.

1.8.3 Digital Doorway project

The Digital Doorway refers to the project that was launched by the CSIR in collaboration with the DST by installing computer equipment in developing areas throughout South Africa. The objective is to allow communities to learn how to use computer equipment by themselves, which is commonly referred to as Minimally Invasive Education.

1.8.4 Information and Communication Technology

A combination of hardware, software and networks as well as a method of communication, engagement and collaboration, which enables the management, processing, and exchange of data, information and knowledge.

1.8.5 Computer literacy

Computer literacy is a general term for the ability to use and understand the language and grammar of computers. It also refers to the kind of knowing that is derived from a computer culture. Being computer literate means the ability to use the mouse, to point, to drag, to drop, to copy, and to browse the Internet.

1.8.6 Internet

The Internet is a network of networks that embraces a wide range of computing, telecommunications, entertainment, publishing and other technologies. The Internet spans digitalised text, sounds, images, and video and are rapidly enveloping other information forms, including kinaesthetic feedback and even olfactory information.

1.9 Program of the study

The study program is organised as follows:

Chapter 1
Introductory Orientation.

Chapter 2
The achievement of computer literacy through unassisted learning.

Chapter 3
The research methodology and strategies applied during the investigation**.**

Chapter 4
Analysis and interpretation of the video-taped observations, personal and focus group interviews.

Chapter 5
Conclusions and recommendations

1.10 Conclusion

In this chapter, we have seen how the concept “Minimally Invasive Education” (MIE) was demonstrated in India. The chapter also outlined the results obtained by Mitra when experimenting with minimally invasive education in the Indian community. Furthermore, the chapter explained the development of South African Digital Doorway projects as a joint venture between CSIR and DST aiming to address the technology illiteracy in South Africa. The research question, problem statement, the methodology to be used in this study and clarification of terms were briefly explained.

The next chapter, which is chapter 2, focuses on becoming computer literate through unassisted learning.

CHAPTER 2: THE ACHIEVEMENT OF COMPUTER LITERACY THROUGH UNASSISTED LEARNING

2.1 Introduction

Initiatives aimed at harnessing ICT for development are hampered by the lack of end-user capacity, technology literacy and an intimidation or lack of confidence to use the technology (Smith et al., n.d.).

The Digital Doorway seeks to verify the hypothesis of Dr Sugata Mitra of the National Institute for Information Technology (NIIT) that Minimally Invasive Education (MIE) is a viable form of education. Through minimally invasive education, a new way of learning by self-discovery emerges.

The aim of this chapter is to explain different learning approaches. The chapter further extends the scope of learning by looking at the Net Generation learning. Challenging as it is, this chapter tried to look ahead to understand how learning is achieved, and the theory underpinning this study.

2.2 Learning approaches

Learning and the understanding of the learning process helps to understand why people behave the way they do. Learning affects people throughout their lives; in school, at home or on the job. Understanding one's personal learning style or method can help a person organise his or her own learning activities.

There are different definitions of learning and explanations of how learning is brought about. For the purpose of this study, it is important to describe and explain the concept “learning” as it is used throughout this chapter. The researcher of this study chose the definition of Howe (1989), Marton and Saljo (1984) and Gagné (1985) because they form part of the practise at the Mamelodi Digital Doorway project.

Howe (1989:4) defines learning as a major force in almost every aspect of human life (in and out of school), and is influenced by a large number of different factors, of which have direct effects on learning. He categorises the causes of human learning into two broad categories:

- The first category consists of activities that the learner undertakes: what a person learns is largely determined by what that individual does.
- The second category is the learner’s existing knowledge: what a person learns is also strongly influenced by what that individual already knows.

Howe (1989:4) uses the word “knowledge” in the broadest sense, to include anything that a person ‘knows’, factual or otherwise, correct or incorrect, and beliefs and attitudes as well as straightforward information.

Howe (1989:4 & 7) explains that two children’s perceptions of the ‘same’ events may be quite dissimilar, because differences in prior knowledge, determined by past learning experiences, lead to contrasting interpretations when placed objectively in identical perceptual inputs.

He further explains that placing two children in the same environment at the same time does not guarantee equivalent environmental influence. They may attend to and perceive different aspects of the situations. Even when they both attend to the same things they may perceive and interpret them quite differently, in ways that largely depend upon the existing knowledge and mental skills of each individual child.

From the above discussion it is important to note that children using the Digital Doorway follow the same processes of learning. As it was mentioned before, the learning station as a stimulating environment attracts children, they then respond to this stimulus by

playing games and music. Some seek information for their studies and work. They process this information and store it for future reference and usage. Children also use their creative thinking skills to acquire information. This is evident where one of the children pressed a button and downloaded a “Mandoza” album and a “Kaizer chiefs” website. This learner was not aware of what he was doing, it happened accidentally, and therefore in future the learner will know which buttons have to be pressed when looking for this information.

Marton and Saljo (1984) in Biggs and Telfer (1987:143) mention the following five conceptions of learning:

- Learning means “knowing more” in some vague way.
- Learning means memorising or learning by heart.
- Learning means acquiring facts and skills that can be retained and used when necessary.
- Learning means finding out what something really means.
- Learning means constructing a personal philosophy or worldview.

Biggs and Telfer (1987:45) mention that the learning process has three broad stages; attending, processing and storing for learning to take place, Marton and Saljo (1984) mention that a process has to be followed.

- **Attending**

This means attending to particular stimuli in an environment. In this case, a massive amount of information is received through our five senses, but it is registered only briefly. This simply means that we attend selectively to only one frail thought at a time.

- **Processing**

This means processing information presented by the selected stimuli. When we make up our minds to attend something must be done with that information. We rehearse information by repeating it repeatedly, or code it by linking it to something we already know.

- **Storing**

After processing the information we need to store the information in the long-term memory in such a way that it can be recalled to consciousness when required in future.

Gagné (1985:2) defines learning as a change in human disposition or capability that persists over a period and is not simply ascribable to processes of growth. He explains that the kind of change called learning exhibits itself as a change in behaviour, and the inference of learning is made by comparing what behavior has possible before the individual was placed in a learning situation and what behaviour can be exhibited after such treatment. The changes may be, and often are, an increased capability for some types of performance. It may also be an altered disposition of the sort called attitude or interest or value.

Gagné (1985:3-4) further explains the following elements of the situation that can be abstracted as having to do with learning:

Firstly, there is a learner, who is a human being. Learners possess sense organs, through which they receive stimulation; brains, by means of which signals originating in the senses are transformed in a number of complex ways; and muscles, by means of which they demonstrate what they have learned. The stimulation that is constantly being received is organised into various patterns of neutral activity, some of which are stored in the learner's memory in such a way that they can be recovered. Such memories may then be translated into action that may be observed as the movement of muscles is executing responses of various sorts.

Secondly, the events that stimulate the learner's senses are spoken of collectively as the stimulus situation.

Thirdly, another important input to learning consists of content recovered from the learner's memory. Such content has an already organised form, which has resulted from previous learning activities.

Lastly, the action that results from these inputs and their subsequent transformations is called a response. Responses are often described in terms of their effects rather than in terms of their appearances. When so classified, they are called performances.

According to Gagné (1985:5-13), research on learning has generated several typical models or prototypes. Such prototypes include conditioning, trial-and-error learning, insight, and the “law of effect”.

It is from this perspective that learning is powerfully affected by what the learner already knows and by what motivates him to learn. An individual’s existing knowledge, acquired through experience makes it possible for that person to understand new information and new events.

Most children are using the Mamelodi Digital Doorway learning station because it is accessible. The fact that some of them have previously used a computer makes them the leaders because they know the most and therefore are termed the “know how” children. In this milieu, the “know how” children are in control of the computer, while the spectators learn how to use the computer. This happens in four ways:

- Minimally Invasive Education: children watch and when they are alone, try to do the same with or without minimal help from the outside.
- Cooperative learning: the “know how” children help and teach them.
- Collaborative learning: some of these children have had experiences with computers.
- Constructivist learning: children construct knowledge and ideas using their own experience.

2.2.1 Minimally Invasive Education

Today’s children are active and creative. They need not only basic education, but also the ability to deal with an increasingly complex and connected world. They do not want to be spoon-fed by instructors or teachers, but want to discover for themselves, build theories and construct knowledge (Papert 1993:141).

In South Africa it has become of vital importance to formulate new and bold solutions to overcome the technological problem as the vast majority of South Africans, living in developing and rural areas, do not have access to computers and are therefore mostly

computer illiterate. Judge (2000) claims that quite soon, adults who are computer illiterate will find it difficult to deal with practically everything in life. It has therefore become essential for today's children to become computer-literate. The Mamelodi Digital Doorway project computer kiosk allows children to become computer literate.

Mitra and Rana (2001) describe a computer literate child as a child who can:

- switch a PC on;
- use Microsoft Paint to draw a picture;
- move objects using drag-and-drop, copy and delete, create folders, cut-and-paste and access programs using the shortcuts provided;
- move form one web page to another and back; and
- send and receive e-mail through a computer with e-mail functionality.

It is against this background that the CSIR, in collaboration with the DST, launched their Digital Doorway projects throughout South Africa to evaluate the feasibility of Dr Mitra's "Minimally Invasive Education" training method. This method is based on a fundamental shift away from a teacher-centred approach to a learner-centred approach in education.

Mitra based MIE on the following hypothesis: The acquisition of basic computing skills by any set of learners can be achieved through incidental learning provided the learners are given access to a suitable computing facility, with entertaining and motivating content, and some minimal human guidance (Smith et al., n.d.).

In his experiment, Mitra was interested in determining if children, given unlimited, free access to computers and the Internet, would be capable of learning how to use a computer without or with little assistance or guidance. For this purpose, he launched the "Hole-in-the-Wall" experiment (O'Connor, 2002). Figure 2.1 illustrates the "Hole-in-the-Wall" kiosk.

Figure 2.1: The "Hole-in-the-Wall" kiosk

A high-speed computer, connected to the Internet was placed in the wall separating their building from the slum area. Children were immediately attracted to the machine installed on their side of the wall (O'Connor, 2002). The children's interaction at the computer was monitored by a remote computer and a video camera, which was mounted in a tree close to the "Hole-in-the-Wall" kiosk (Judge, 2000). It was found that children were capable of teaching themselves to browse on the Net and to draw by means of the computer. They also learnt how to point and click, and by the end of the day children were browsing the Internet (O'Connor, 2002).

The essential features of "Hole-in-the-Wall" experiments include playground setting, collaborative learning' utilization of the learning station' integration with the school system' learning to learn and projects by children (http://www.theholeinthewall-anew way to learn. htm).

- **Playground setting**

The learning station, which children can access at any time, is set up in an outdoor playground setting. The playground setting offers a host of advantages:

1. Unconditional access to learning stations ensures that both children in school and out-of-school can use them.

2. The unstructured nature of this setting ensures that children themselves take ownership of the learning station by forming self-organised groups who learn on their own.
3. Finally, an unsupervised setting ensures that the entire process of learning is learner-centric and is driven by a child's natural curiosity.

- **Collaborative learning**

The learning station fosters collaborative learning among groups of children instead of following the usual school model of rote-based learning. This allows children to explore, learn, share and learn even more because of this exchange of knowledge. This multiplier effect of collaborative learning is utilised fully by children using the learning station.

- **Optimum utilisation of learning station**

In a traditional computer lab setting, pedagogy is instruction-based where focus is on dissemination of information. Moreover, the access to a computer is restricted by average usage time available per user. As opposed to this, the "Hole-in-the-Wall" learning station relies more on exploratory learning where children can freely experiment on the learning station. Again, groups of children access the learning station leading to twin advantages of collaborative learning and multiple children using the learning station at the same time. This leads to much greater impact on children than a traditional lab-based setting.

- **Integration with the school system**

A big advantage of the "Hole-in-the-Wall" learning station is that it fits in nicely with traditional schooling and seeks to reinforce structured learning through peer discussions, increased curiosity and better retention. The learning station thus seeks to enhance the effectiveness of overall learning experience by integrating with the schooling system.

- **Learning to learn**

Apart from addressing the issue of education skills, the learning station addresses a more fundamental skill set. By encouraging children to explore the learning station, it seeks to empower them with problem-solving skills and an ability to think critically. While a child learns how to use educational software, he also develops an ability to analyse, synthesise and evaluate information, which in turn builds his long-term ability to learn.

- **Projects by children**

The learning station is used for various real-life projects. These projects are designed to engage children in authentic tasks relevant to their daily lives. Moreover, they are designed to be locally relevant so that children can directly relate to them. Children can then use the learning station for culling out information, compiling data and preparing reports. This will help develop their personalities while engaging them in tasks, which could be of use to local community.

2.2.2 Cooperative learning

The human species seems to have a cooperation imperative: we desire and seek out opportunities to operate jointly with others to achieve mutual goals (Johnson & Johnson 1991:6).

Cooperation is an inescapable part of human nature and human life. It is difficult to think of many human activities in which the ability to cooperate with others is not important. Cooperation is the heart of family life, economic systems, legal systems and the worldwide community of humans.

While social-psychological research on competitive versus cooperative learning can be traced to the early 1900's it is alarming that cooperation traditionally has been the most underutilised goal structure in education (Johnson & Johnson 1991).

Kagan (1990:11) criticises this practise when he states:

> *…students need to learn to compete; they need to be able to work alone. An individualistic orientation is often very adaptative. However, they also need to work together. The problem I have with traditional approach is not that it's too competitive or individualistic; it's that it almost never includes any cooperative activities.*

Cooperative learning refers to learning environments that are specifically structured to emphasise peer interaction in the context of cooperative goals rather than the individual or competitive goals of the traditional classroom (Hoyles, Healy & Pozzi, 1992; Light & Mevarech 1992).

The concept of cooperative learning is based on theories that advocate that:

> *…socio-cognitive conflicts and negotiation of joint action are two mechanisms by which social interaction is said to lead to effects on individuals' cognitive functioning (Hoyles et al., 1992:240).*

The wide umbrella of cooperative learning techniques, thus, stems from two principle rationales (Light & Mevarech 1992):

- The social rationale: the benefits of cooperative learning are ascribed to the inherent strengths of social interaction.
- The cognitive rationale: the benefits of cooperative learning are due to the resolution of cognitive conflicts within social interaction.

Table 2.1 gives a more detailed clarification of the reasoning behind these two rationales

Social rationale	**Cognitive rationale**
Educational sociologists assume that: Learning under positive contact conditions can facilitate interpersonal relationships which in turn may have positive effects on students' ▪ motivation, ▪ self-esteem, and ▪ academic learning	Cognitive psychologists assume that: Cognitive interactions can involve different features, e.g. ▪ conflict resolution ▪ metacognitive processes that facilitate learning in small groups, and have positive effects on cognitive development.

Table 2.1: Rationale behind cooperative learning.

Studies by Slavin (1987) found that when people work together towards a common goal:

- They express norms in support of doing whatever helps the group achieve its goal.
- They produce more and better ideas than do individuals working alone or competitively.
- They learn to like one another.

- They enjoy working together.

The literature (Damon & Phelps 1989:9-19) distinguishes between two main schools of thought concerning cooperative learning and its effects, namely the developmental perspective and the motivational perspective. Table 2.2 differentiates between these two schools of thought.

Developmental perspective	**Motivational perspective**
Piaget and Vygotsky	Lewin, Deutsch, Atkinson and Skinner
Intrinsic growth processes like ▪ social-cognitive conflict and co-construction produce positive learning effects during interaction.	Extrinsic rewards are necessary to get the children to interact productively.

Table 2.2: Perspectives on cooperative learning

The two developmentally oriented approaches by Piaget and Vygotsky dominate the psychological research on cooperative learning. Both Piaget and Vygotsky were, to some extent, constructivist (Watts, 1991) and contributed to the theory that "conceptual development has an essentially social genesis" (Palinscar, Stevens & Gavelek, 1989:43). The basic assumptions underlying these two approaches are contrasted in Table 2.3.

Piaget	**Vygotsky**
Cognitive rationale	Social rationale
▪ Socio-cognitive conflicts push individuals "to produce higher level restructure actions of understanding of the task and of its solutions" (Barbieri & Light 1992:200).	▪ "Cognitive growth may result from interactions in which interpersonal conflict is not apparent" (Nastasi & Clements 1992:216).

▪ Cooperative learning is effective, because "it promotes socio-cognitive conflicts due to different opinions and strategies employed by the partners" (Mandl & Renkl 1992:281).	▪ "Mechanisms which are not conflict-based, such as co-constructive processes are significant sources of cognitive growth as well" (Mandl & Renkl 1992:281).

Table 2.3: Developmental approaches of Piaget and Vygotsky

Mitra and Rana (2001:231) point out that the following processes emerged when children taught one another in using the computer:

- One child explores randomly in the Graphic User Interface (GUI) environment; others watch until an accidental discovery is made.
- Several children repeat the discovery for themselves by requesting the first child to let them do so.
- While busy repeating the first accidental discovery, one or more children make more accidental or incidental discoveries.
- All the children repeat all the discoveries made and, in the process, make more discoveries. While making discoveries, they also create their own vocabulary to describe their experiences.
- The vocabulary encourages them to perceive generalization.
- They memorise entire procedures for doing something, e.g. how to open a programme and retrieve a saved picture.
- They teach one another shorter procedures for doing the same thing, whenever one of the finds a new, shorter, procedure.
- Children divide themselves into two distinct groups, the "know" and the "know nots". They realise that a child that knows will part with that knowledge in return for friendship and exchange as opposed to ownership of physical things where they could use force to get what they did not have.
- A stage is reached when no further discoveries are made and children occupy themselves with practising what they have already learned. At this stage, intervention usually occurs and a new discovery is introduced followed by another self-instructional cycle.

Mitra and Rana (2001:232) found that during the self-instructional cycle, children actually formed impromptu classes where thy taught another. The “Hole-in-the-Wall” experiments have indicated that children between the ages of 6 and 13 are capable of teaching themselves how to use the computer. Mitra (2003: x) emphasised that this self-instruct ability of children is independent of their:

- educational background;
- literacy levels in English or for that matter in any other language;
- economic or social level;
- place of origin, that is town, city or village and ethnicity;
- gender;
- genetic background;
- geographic location;
- intelligence.

Working in groups is essential in Minimally Invasive Education as the process depends on discovery and exploration. The main paradigm of MIE is collaborative constructivism as Mitra (2003) explains:

> *…children teach one another very effectively and are effective at self-regulating the process. That is how over 100 children are able to use one computer.*

2.2.3 Collaborative learning

In the South African contest, the Digital Doorway projects encourage a learner-centred approach, where learners are expected to be actively involved in the learning process and work collaboratively. This approach of learner-centredness is emphasised by South Africa’s current educational approach “Outcomes Based Education (OBE). The Department of Education (2003:13) identified Information and Communication Technology (ICT) as one of the most powerful tools of supporting learners to achieve the national critical outcomes as it encourages:

- A learner-centred approach.
- Active, inquiry-based and hands-on learning.

- Collaboration amongst learners and facilitators.
- Critical thinking, creativity, informed decision-making and analytical skills.

Collaborative learning is included in this study because the learning station fosters collaborative learning among groups of children instead of following the usual school model of rote-based learning. This allows children to explore, learn, share and learn even more because of this exchange of knowledge (http://www.theholeinthewall-anew way to learn. htm).
Alessi and Trollip (2001:34) define collaborative learning as “environments in which learners work on a shared project or goal”.

In the process of collaborative learning, children share construction of learning and ideas (Balkcom 1992: x). Growing research on this learning demonstrated the benefits of children working with other children. They share the process of constructing their ideas when they collaborated (Rysavy et al., 1991:70-79).

Gerdi (1999: x) on the other hand, view collaborative learning as:

> *…a philosophy of teaching, working together, building together, learning together, changing together, and improving together. A philosophy that fits today’s globalised world.*

Gerdi (1999: x) put an emphasis on the word “together”. This means everything is done as a mutual group or as pairs where an object is shared. If different people learn to work together in the classroom, then they will become better citizens of the world. “Learning is enhanced when it is more like a team effort than a solo race. Good learning, like good work, is collaborative and social, not competitive and isolated. Sharing one’s ideas and responding to other’s improves thinking and deepens understanding”

Judge (2000) in Johnson and Johnson (1986:31-32) also views collaborative learning as an instruction method in which students at various performance levels work together in small groups toward a common goal. The students are responsible for one another’s learning as well as their own. Thus, the success of one student helps other students to be successful.

Proponents of collaborative learning claim that the active exchange of ideas within small groups not only increases interest among the participants but also promotes critical thinking. Johnson and Johnson (1986:32) support the above views by indicating that collaborative learning is a philosophy of interaction and personal lifestyle where individuals are responsible for their actions, including learning and respect the abilities and contributions of their peers.

The shared learning gives students an opportunity to engage in discussion, take responsibility for their own learning, and thus become critical thinkers (Totten, Sills, Digby & Russ 1991).

2.2.4 Constructivist learning

Children are not seen as empty vessels into which we can pour knowledge; rather, they are theory builders who construct and rearrange knowledge based on their experience in the world (Piaget 1972).

Constructivist learning is used in this study because children build new knowledge structure based on their experience. Mitra and Rana (2001:223) state that constructivism talks about cognitive growth and learning. They mention that one of its foundational premises is that children actively construct their knowledge rather than simply absorb ideas propagated by teachers.

According to Mitra and Rana (2001:223) constructivism posits that children actually invent their ideas. They assimilate new information from simple, pre-existing notions, and modify their understanding in light of new data. In the process, their ideas gain in complexity and power, and with appropriate support, they develop critical insight into how they think and what they know about the world.

Perkins in (Brandt 1990) argues that the goal of instruction is not to ensure that the individual knows facts, but rather to construct plausible interpretations thereof, including alternative perspectives. He emphasises that the active learner is not only an active processor of information, but also elaborates on and interprets the information. He claims that a constructivist approach need not only be discovery learning, but may also

focus on more direct instruction as long as the emphasis remains an exploration, extrapolation and the giving of evidence regarding the process. Learners must learn to construct concepts and apply them by going “beyond the information given” (Perkins 1991).

In addition to the above statement, Piaget (1973) points out that knowledge is not simply acquired by children bit by bit, but constructed into coherent, robust frameworks called “knowledge structures”. He further states that children build these structures based on their experience in the world.

Piaget discovered that children are not just passive absorbers of experience and information, but active theory builders. In one of his more famous experiments, he discovered that young children believe that water can change in amount when poured from a short, wide glass into a tall, thin one. These children have built a theory, which indeed, works most of the time that states ‘taller means more’. Mere insistence could not convince these children that the water did not change its amount. In other words, you could not simply tell these children the ‘right’ answer. They had to build a new, more sophisticated knowledge structure that takes into account the theory, again based on their experience.

Bruner (1990:2) also views learning as an active process in which learners construct new ideas or concepts based upon their current or past knowledge. He mentions that the learner selects and transforms information, constructs hypotheses, and makes decisions, relying on a cognitive structure to do so. Cognitive structures (schema, mental models) provide meaning and organisation to experiences and allow the individual to go beyond the information given.

From these views of Piaget and Bruner, one can draw a line of distinction where it is discovered that Bruner proposed learning as an active social process in which children use their current knowledge to construct new ideas or concepts (Chorlton, 2002:76). Unlike Piaget, Bruner suggests that children’s development is accelerated by giving them tasks they are capable of accomplishing, rather than tasks that are beyond them. They build on success, not failure in tackling new tasks; children use the information they already have to help them go beyond the information given.

Mitra and Rana (2001:223) explain that students control and construct their own knowledge acquisition by choosing what they can learn through exploration and play. They further explain that constructivism is an idealised form of education in which students learn through stimulated real-world situations. In their explanation, they mention that many software programs attempt to utilise the constructivist assumptions of teaching and learning to enhance what students will learn.
Mitra and Rana cite simulation as an example of constructivist software program used as the most common real-world experience. The computer is useful for simulating this rich perceptual environment because of the availability of text, sound, graphics, animation, and multimedia. They further explain that in order to simulate the real worlds, learners must be provided with a rich environment of sensory experiences to which they can respond.

To emphasise Mitra and Rana's idea that students control and construct their own knowledge acquisition by choosing what they can learn through exploration and play, Garvey (1977:7-10) points out how play has an important role in learning. He explains that play is most frequent in a period of dramatically expanding knowledge of self, the physical and social world and systems of communication. To Garvey, play is viewed as cathartic – an attempt to re-experience and thereby to master a difficult situation. He further cites certain descriptive characteristics of play as:

- Play is pleasurable, enjoyable. Even when not actually accompanied by signs of mirth, the player still passively values it.
- Play has no extrinsic goals. Its motivations are intrinsic and serve no other objectives.
- Play is spontaneous and voluntary. It is not obligatory but is freely chosen by the player.
- Play involves some active engagement on the part of the player.

According to Collins (1991:29) constructivism shifts the attention from teaching to learning where students are to construct their own understandings and capabilities in carrying out challenging tasks. To become more precise, Papert (1980) used Piaget's model of building where children are seen as builders of their own intellectual structures.

Papert (1980:7) points out that all the builders need building material to enhance their building skills; therefore, these children use the computer to build their knowledge. Papert (1980:7) further explains that children seem to be innately gifted learners, acquiring learning before they go to school a vast quantity of knowledge by a process he calls “Piagetian learning,” or “learning without being taught”.

It is from this discussion that children using the Digital Doorway learn in a constructivist way. Children actively construct their understanding of the world because of what has been learned in prior experiences (http://www,aace.org). Children learn better through active participation in activities that are directly relevant to learning, because each individual learns in a different manner and has different learning experiences to draw from. The situation of learning affects learning and differs for each person. Children control and construct their own knowledge acquisition by choosing what they can learn through exploration and play. These interactions lead children to discover rules and concepts that can be used to solve problems.

Tapscott (1998:156) talks about interactive media as a new teacher. He notes that interactive media can improve the learning process dramatically. The learners learn to cooperate, work in teams, solve problems and take responsibility for their own learning. The model is that everyone relies on everyone else, sharing his or her expertise. Tapscott (1998:156) cited Richard when saying:

> *There is something that happens when you decide for yourself that you are going to learn something and do something. This is much more powerful than when someone else says you have to do.*

According to Saunders in Tapscott (1998:156), children not only learn about the new media and develop language and presentation skills; they learn how to interact with clients and meet deadliness and most importantly, they learn about how to share expertise and how to source it as well. It is from this notion that Tapscott (1998:156) describes these children as the Net Generation.

2.3 Net generation

Tapscott (1998:156) describes the Net generations by explaining their personality as well as their learning.

2.3.1 Net generation's personality

According to Tapscott (1998:156) this generation's personality is characterised by curiosity, assertiveness and self-reliance.

- **Curious generation**

Every generation shows curiosity. Childhood is all about exploration, discovery and investigation. The shift from broadcast to interactive world elicits intensely heightened curiosity.

- **Assertiveness**

Access to the media enables children to asset themselves more than any previous generation. Free zone moderator Ellis in Tapscott (1998:97) describes it as "a generation that is always sticking up for themselves – taking what is theirs". They begin to develop self-reliance at an early age: they can find what they want and what they need quickly, easily and honestly.

- **Self-reliance**

The self develops when children can imagine what others are thinking about them and realise the meaning of actions taken by others towards them. Piaget (1972) in Tapscott (1998:94) explains that the construction of the self occurs as the child acts on its environment – as the child takes actions to understand what he or she can do. The actions taken on the Net involve reading, assessing, imagining, composing sentences, searching for information, discovering new places and interacting with others.

2.3 2 Net Generation's learning

Tapscott (1998:127) cites global learning as one of the earliest and most elegant examples of how the Internet can bring the world into the classroom of the nation. He explains that the new media tools offer great promise for a new model of learning – one based on discovery and participation. He further explains that in adopting the new interactive model of learning, Net Generations are already assimilating the learning goals. Learners rely on one another for learning. They debate everything online. They are critics; they are tolerant of diversity in their worlds. The students teach themselves. While they are at it, they can probably teach their teachers as well.

Learning organisation theorist Senge (1990) in Tapscott (1998:137) mentions that learning is social and tends to occur in teams. He further mentions that most understanding is socially constructed. Through conversation and dialogue, children come to their own understanding of an experience.

Tapscott (1998:141) adds this view by explaining that the new media have helped create a culture for learning where the learner enjoys enhanced interactivity and connections with others. Rather than listening to some professor regurgitating facts and theories, students discuss and learn from one another with the teacher as a participant. They construct narratives that make sense of their own experiences.

According to Tapscott (1998:139-147) the N-Gen's experience to date with digital media points to a new paradigm in learning. He explains that by exploiting digital media, educators and students can shift to a new, more powerful and more effective learning paradigm. He further points out eight shifts of interactive learning:

- **From linear to hypermedia learning**

Traditional approaches to learning are linear. This dates back to the book, which is usually read from the beginning to the end, as a learning tool. Television shows and instructional videos are designed to be watched from beginning to end. Nevertheless, N-Gen access to information is more interactive and non-sequential. When surfing some new material, they hyper-link to servers and information sources all over.

- **From instruction to construction and discovery**

Educators describe this approach as the constructivist approach. Rather than assimilating the knowledge broadcast by an instructor, the learner constructs knowledge anew. Constructivists argue that people learn best by doing rather than simply by being told: constructivism as opposed to instructionism.

Papert (1996) cited by (Tapscott, 1998:144) says “The scandal of education is that every time you teach something, you deprive a child of the pleasure and benefit of discovery.” The schools can become a place to learn rather than a place to teach.

> *Pedagogy had to do with optimising the transmission of the information. What we now find is that children do not want optimised, predigested information. They want to learn by doing – where they synthesise their own understanding – usually based on trying things out.* (Brown, 2002).

Papert (1998:144) illustrates the difference in his lucid book, “The Connected Family.” He explains that an instructionist might make a game to teach multiplication tables. A constructionist presents learners with the challenge of inventing and creating the game.

- **From teacher-centred to learner-centred education**

The new media enables centring the learning experience on the individual rather than on the transmitter. Further, it is clear that learner-centred education improves the child’s motivation to learn. Learner-centred education begins with an evaluation of the abilities, learning style, social context and other important factors that affect learning.

- **From absorbing material to learning how to navigate and how to learn**

N-Gens assess and analyse facts. They synthesise. They engage with information sources and other people on the Net and build or construct higher-level structures and mental images.

- **From school to lifelong learning**

Tapscott (1998:146) cites Soderberg of the National Technological University when saying:

> *People mistakenly think that once they have graduated from university they are good for the next decade – when they are really good for the next ten second.*

This is a reflection of the knowledge explosion in which the knowledge base of humanity is now doubling annually.

- **From one size fits all to customised learning**

Digital media enables students to be treated as individuals having highly customised learning experiences based on their background, individual talents, age level, cognitive style, interpersonal preferences, etc. Papert (in Tapscott 1998:147) says, “of the one age-class-room-first all model ‘community of learning’ shared by students and teachers, socialization is not best done by segregating children into classrooms with children of the same age”. The computer is a medium in which what you make lends it to be modified and shared. When children get together on a project, there is abundant discussion; they show it to other children, other children want to see it. Children learn to share knowledge with other people much more than in the classroom.

- **From learning as torture to learning as fun**

It is said that if learning is fun it cannot be challenging. Why should learning not be entertaining? Webster’s Ninth College Dictionary gives the third and fourth definitions of the verb “to entertain” as to “keep, hold, or maintain in the mind”, and to “receive and take into consideration.” In other words, entertainment has always been a profound part of the learning process and teachers have throughout history, been asked to convince their students to entertain ideas. From this perspective, the best teachers were the entertainers using the new media; the teacher becomes the entertainer and in doing so builds enjoyment, motivation, and responsibility for learners.

- **From the teacher as transmitter to the teacher as facilitator**

Learning is becoming a social activity facilitated by a new generation of educators. The teacher is not an instructional transmitter. He is a facilitator of social learning whereby learners construct their own knowledge. More importantly, learners have acquired collaborative, research, analytical, presentation, and knowledge. With the assistance of a teacher, learners are constructing knowledge and their world.

From this discussion, the researcher deduces that without any shadow of doubt learning at the Mamelodi Digital Doorway takes place through Minimally Invasive Education, cooperative, collaborative and constructivist learning, and therefore these children are also motivated to learn; there is no one who forces them to learn as they learn voluntarily.

2.4 How does learning take place at the Mamelodi Digital Doorway project?

What an individual can learn, and how he learns it, depends on what models he has available (Howe 1989:4).

The South African Digital Doorway project was generated from an idea of unsupervised learning pioneered in an experiment started in India by Professor Sugata Mitra of NIIT Centre for Research in Cognitive Systems (CRCS). Coining the term Minimally Invasive Education (MIE), Mitra proposed that basic computer skills can be acquired by children through incidental learning and by peer tutoring (Judge, 2000).

The literature survey covers a theoretical proposal by Cronjé (2000, 2006). This is followed by a discussion of Ausubel's (1962) meaningful learning, and finally by Malone's (1981) theory of intrinsic motivation.

Smith and Ragan (1999) cited by Cronjé and Burger (2006) take an information processing approach, and suggest that the primary load of information processing could either be generated by the learner (generative) or supplied by the instructor (supplantive). Table 2.4 illustrates attributes to learning that explain the two terms.

Children at the Mamelodi Digital Doorway project use their experience to construct and acquire new knowledge -specifically thinking, feeling, watching and doing, which children acquire through imitating their fellow users of the computer. This type of experience is also built in a social context; it is not done in isolation.

Generative event	Supplantive event

Activate attention for lesson	Gain attention to lesson
Establish purpose	Inform learner of instructional purpose
Arouse interest and motivation	Stimulate learners attention and motivation
Preview learning activity	Provide overview
Recall relevant prior knowledge	Stimulate recall of prior knowledge
Process information and example	Present information and examples
	Gain and direct attention
Focus attention	Guide or prompt use of learning strategies
Employ learning strategies	Provide for and guide practise
Practise	Provide feedback
Evaluate feedback	Provide summary and review
Summarise and review	Enhance transfer
Transfer learning	Provide re-motivation and closure
Re-motivate and close	Conduct assessment
Assess learning	Provide feedback and remediation
Evaluate feedback	

Table 2.4: Generative and supplantive learning events (Smith & Ragan 1999)

2.4.1 Cronjé's teaching and learning theory

Cronjé (2000, 2006) suggests a matrix forming four quadrants of learning: construction, injection, integration and immersion (see figure 2.2). Cronje's model is used in this study to measure to what extent the users of the Mamelodi Digital Doorway project function in each quadrant.

- **Construction**

Construction is high in complex knowledge and constructivist elements. The pedagogy of this quadrant is of the type where learners are given a problem to solve, usually involving constructing some solution, in the belief that they "will do best by finding ('fishing') for themselves the specific knowledge they need" (Papert, 1993: 139). Learning tasks could typically involve the construction of websites, databases or even toy robots.

- **Injection**

Diagonally opposed is the quadrant of Injection, which amounts to direct instruction along the lines of traditional computer-based tutorials or drills, and military training, where the instruction seeks to optimise efficiency by a transfer of knowledge in as clinical, undiluted and sterile a fashion as a medical injection.

- **Integration**

The third quadrant is Integration, which refers to carefully-planned learning events or lessons during which tasks and exercises are blended to achieve efficient transfer of knowledge by direct instruction and effective learning by constructive application of that knowledge.

- **Immersion**

The Immersion quadrant refers to learning that is predominantly incidental by nature and usually gained in an unplanned fashion, often referred to as serendipity or experience. An example would be that of a small child learning the hard way that a bee stings painfully.

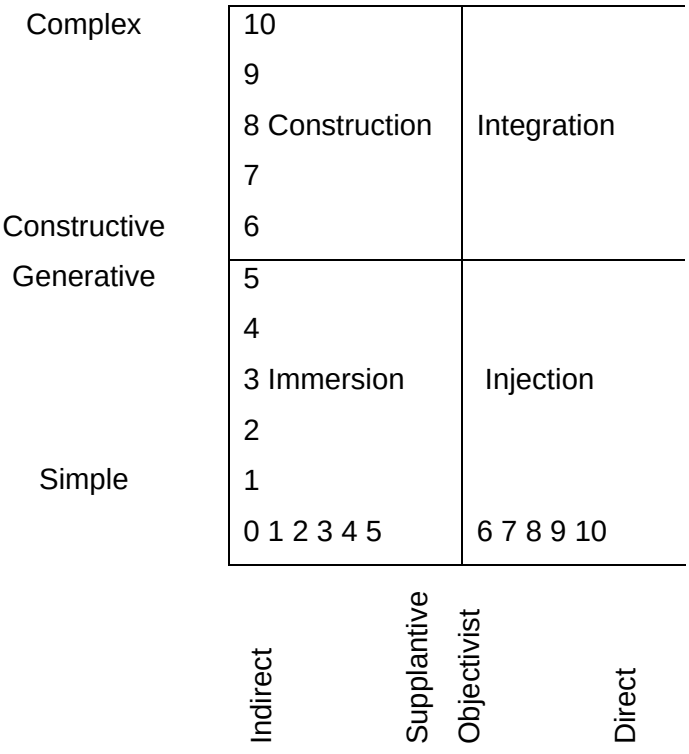

Figure 2.2: Four quadrants of teaching and learning (Cronjé 2006)

Children at the Mamelodi Digital Doorway project learn in social groups where they discover and construct meaningful learning. For the purpose of this study Ausubel's meaningful learning will form part of the study.

2.4.2 Ausubel's theory of meaningful learning

To learn more about meaningful learning Ausubel (1962) believes receptive learning can be just as meaningful as discovery. His theory is based specifically on rote vs. meaningful learning, and reception vs. discovery learning.

- **Rote and meaningful learning**

Good and Brophy (1990:126) say that in an attempt to acquire meaningful knowledge, the learner can approach the task in two different ways. Materials learned that have relation to experiences or memories that are firm in person's memory are more likely to be retained whereas, "rotely learned materials are discrete and isolated entities which have not been related to established concepts" and may soon be forgotten (Ausubel, 1962). On the other hand, if a person attempts to create some connection to something that they already know, they experience meaningful learning.

Ausubel (1962) explains that meaningful learning is closely connected to the process of knowledge retention within cognitive structures. Rote memory as he mentions, works at times for short-term memory. Knowledge can only be effectively retained if it is meaningful, and thus must be processed in the mind.

- **Reception and Discovery learning**

According to Langford (1989:55) supporters of discovery learning declare that this learning is where real knowledge is obtained, where conservation of memory is ensured and sub-verbal; awareness is first encountered. In addition to this, Good and Brophy (1980:192) quote Bruner when he says,

> *The most meaningful learning takes place when it is motivated by the students' own curiosity and uncovered by individual or group exploration.*

This learning theory of Ausubel is clearly related to the learning that takes place at the Mamelodi Digital Doorway project because children learn from the experience that they gained previously. This experience may have been the one they gained from school or home or from their peers while watching them playing the computer. From this experience, they build their mental models as information is stored into the long-term memory and used or retrieved in future.

Brown (2002) supports Ausubel's meaningful learning theory by explaining that an observation of children working with digital media suggests "bricolage". Bricolage, as he explains, is a concept studied by Claude Levi-Strauss, which relates to the concrete. It has to do with abilities to find something – an object, tool, document, and a piece of code-and to use it to build something you deem important. It is from this explanation that even children using the Mamelodi Digital Doorway project learn to become bricoleurs.

Children at the Mamelodi Digital Doorway project do not only use the computer for the sake of using it, there is no teacher or instructor who forces them to use the computer, but they are motivated to use it time and again. Concisely one may say that they use it freely, spontaneously and voluntarily. To support this idea Malone (1981:433-469) propagates a theory of intrinsic motivation, where children become curious about their learning.

2.4.3 Malone's theory for intrinsic motivation

Malone (1981:433-469) presents a theoretical framework for intrinsic motivation (those that come from within the person, such as one's personal interest) in the context of designing computer games for instruction. He argues that intrinsic motivation is created by three qualities: challenge, fantasy and curiosity.

- **Challenge**

Challenge depends upon activities that involve uncertain outcomes due to variable levels, hidden information or randomness. According to Malone (1981) the most important principle is that the level of challenge should be individualised for and adjusted to the learner. This simply means that a lesson should not be too easy, but also not too difficult.

- **Fantasy**

Fantasy depends upon skills required for instruction. Fantasy situations encourage learners to imagine themselves in an imaginary context or events using vivid realistic images. This explains that in any lesson, it may be valuable to encourage learners to envision themselves in a situation where they can really use the information they are learning.

- **Curiosity**

Curiosity can be aroused when learners believe their knowledge structures are incomplete, inconsistent, or unparsimonious. Malone (1981) differentiates between sensory curiosity and cognitive curiosity. Visual or auditory effects that are surprising or attract attention arouse sensory curiosity. Cognitive curiosity is aroused by information that conflicts with the learner's existing knowledge or expectation, is contradictory, or is in some way incomplete. These situations encourage the learner to seek new information that remedies the conflict.

According to Malone (1981) intrinsically motivating activities provide learners with a broad range of challenge, concrete feedback, and clear – cut criteria for performance. Malone's theory of intrinsically motivating instruction explains that self-regulated learning has three main characteristics:

Firstly learners find the environment to be intrinsically motivating, that is, they find participating in the activity to be its own reward and do not seek or need external incentives.

Secondly, self-regulated learning is metacognitively active. Learners actively engage in planning and goal setting and are able to monitor and evaluate their own learning.

Thirdly, self-regulated learners are behaviourally active in that they take the necessary steps to select and structure the environment to best suit their own learning styles. Learner control is essential for self-regulated learning.

2.5 Conclusion

We have seen how the learning station uses children's natural curiosity and focuses on providing an enabling environment where they can learn on their own. Children, in the process of freely experimenting with the learning station, pick up critical problem-solving skills. It also provides a collaborative setting where they can share their knowledge and in the process, develop better group dynamics, all in a highly natural environment. This is evident when children are observed working together in small groups of about five to ten, helping one another and sharing a single terminal computer.

As mentioned previously, the "know how" children assist those that do not know the computer in researching, discussing and group decision-making. In this milieu, one discovers that cooperative learning embodies the biblical values of sharing, listening, expressing one's faith to others, and learning from one another. In cooperative learning, the computer becomes a means to an end, that is, a tool to promote the sharing of ideas and peer-to-peer relationships.

Because children approach this technology with varying skill levels and each program has a unique set of navigational controls, children often need one another's help. Through research and the sharing of information and ideas, children construct a group understanding or larger picture, which leads them toward new meanings and insight. "When students work together they experience better acquisition, retention and interaction of content" (Mac Queen 1999).

Children construct knowledge from their experience. The experience that we talk about is what they gain by observing their peers when using the computer. Piaget believes that children are not just passive receivers of environmental stimulation; instead they are naturally curious about their world and actively seek out information to help them understand and make sense of it (Collins, 1991:28-36). For example, the 'know how' children at the Digital Doorway already know something concerning the computer. This is why they become leaders and help others in learning the computer.

By the use of this free technology that is also child-centred, they are motivated to frequent the learning station and to use their experience to learn new information. Even if children use the same computer, their learning skills differ as their experiences are not the same.

In conclusion Tapscott (1998:2) explains that there is a shift in learning: from generation gap to generation lap where children are outpacing and overtaking adults on the technology track, lapping (children outpacing and overtaking adults on the technology track) them in many area of daily life. These children are far more ahead than their parents are as far as technology is concerned, because they can programme the VCR in the house and fiddle with all the features of parents' cell phones.

Most of the adults do not know how to programme household appliances, even their cell phones. Always when they meet a technological challenge, they request assistance Brown (2002) from children. Tapscott (1998:36) cites Locke when summarising it perfectly:

> *For once in our civilization, children are educating older people. Children are more adept at using computers. Parents, teachers, and other adults are looking to children for information and help with computers and other computer related stuff.*

The next chapter, which is Chapter 3, describes the research methodology and strategies applied during the investigation.

CHAPTER 3: THE RESEARCH METHODOLOGY AND STRATEGIES APPLIED DURING THE INVESTIGATION

3.1 Introduction

McMillan and Schumacher (1993:x) point out that before a researcher designs a study, he/she has an idea of the research problem and should therefore select a research orientation that is suitable for the study. McMillan and Schumacher (1993: x) posit that an approach usually refers to the nature of knowledge, how the researcher understands the world, the purpose of the study, and how data are collected and analysed.

It is from this point of view that the purpose of this chapter is to outline the research paradigm, the research methodology and design. This chapter further describes the methods of data collection and data analysis, methods of ensuring validity and reliability, as well as ethical considerations.

3.2 Research paradigm

Paradigms are all-encompassing systems of interrelated practise and thinking that define for researchers the nature of their enquiry along three dimensions: ontology, epistemology and methodology (Terre Blanche & Durrheim, 1999). Ontology specifies the nature of reality that is to be studied and what can be known about it. Epistemology specifies the nature of the relationship between the researcher (knower) and what can be known while methodology specifies how the researcher may go about practically studying whatever he or she believes can be known.

3.2.1 Positivist, interpretive and constructionist paradigms

Terre Blanche and Durrheim (1999:4) explain the three dimensions of paradigms in the following table.

	Ontology	Epistemology	Methodology
Positivist	Stable external reality Law-like	Objective Detached observer	Experimental Quantitative Hypothesis testing
Interpretive	Internal reality of subjective experience	Empathetic Observer inter-subjectivity	Interactional Interpretative Qualitative
Constructionist	Socially constructed reality Discourse	Suspicious Political Observer constructing versions	Deconstruction Textual analysis Discourse analysis

Table 3.1: Three dimensions of the paradigms

The three dimensions of these paradigms shown in the above table constrain one another. If the researcher believes that what is to be studied consists of a stable and unchanging external reality, then she or he can adopt an objective and detached epistemological stance towards that reality, and can employ a methodology that relies on control and manipulation of reality. If, on the other hand, the researcher believes that the reality to be studied consists of people's subjective experiences of the external world, she or he may adopt an intersubjective or interactional epistemological stance toward

that reality, and use methodologies such as interviewing or participant observation that rely on a subjective relationship between researcher and subject. This is characteristic of the interpretive approach, which aims to explain the subjective reasons and meaning that lie behind social action.

Finally, if the researcher believes that reality consists of a fluid and variable set of social constructions, she or he may adopt a suspicious and politicised epistemological stance, and employ methodologies that allow the researcher to deconstruct versions of reality. This is the characteristic of constructionist research.

Many researchers conduct most of their research within a single paradigm, in the same way that artists typically prefer a certain style. Thus positivism may suit those who are after what they believe to be objective facts. Interpretive research may be suited for those who care about the meanings people attach to such ‘facts’, and social constructionism may suit those who wonder how the social world gets constructed as one, which contains ‘facts’ in the first place.

Since people’s subjective perceptions and experiences are such an important, if not defining factor in the acquisition of functional computer literacy skills, I believe an interpretive approach to be the most appropriate for the objective of this study. I tried to find out how Minimally Invasive Education supports the acquisition of the computer literacy skills at the Mamelodi Digital Doorway. For this qualitative approach observation, semi-structured interviews and focus group interview were used as data collection methods.

Interviews were conducted with the volunteer group of children who frequently use the Mamelodi Digital Doorway. The purpose of these interviews was to get more information about how children acquired computer literacy skills in a minimal way. Questions asked during the interview focused on specific items from the sub-questions, but varied depending on the responses given by the children.

3.3 Research design and methodology

It is important before research is undertaken to create guidelines that are going to give order and direction to the research project to assist the research and not to lose focus of the research inquiry. This is done through research design and methodology.

3.3.1 Research design

A research design is a strategic framework for an action that serves as a bridge between research questions and the execution or implementation of the research. Research designs are plans that guide the arrangement of conditions for collecting and analysis of data in a manner that aims to combine relevance to research purpose with economy in procedure (Terre Blanche & Durrheim, 2002:29).

According to Barbie (1998:89) a research design addresses the planning of scientific inquiry, designing a strategy to explore, describe and explain something. There are two broad approaches that are usually adopted by researchers to gather data, namely qualitative and quantitative approaches.

In this research, a descriptive qualitative approach was followed to be able to investigate how children at the Mamelodi Digital Doorway project acquire computer literacy skills using their own intuition and exploration.

3.3.2 Qualitative research strategies applied

A qualitative research method was adopted because this research aims at interpreting the phenomenon under study in terms of the meanings that the participants brought to it (Greenhalgh & Taylor 1997:740-743). Maykunt and Morehouse (1994:43) describe qualitative research as being exploratory and descriptive in focus, and purposive in sampling with the emphasis on people as instruments.

Qualitative research is a form of social inquiry that focuses on the way people interpret the socially constructed nature of reality and makes sense of their experiences and the world they live in (Denzil & Lincoln 2000:8; Hollaway & Wheeler 2002:3). According to Gay and Airasian (2003:9), qualitative research methods are based on collection and analysis of data such as observations, interviews and focus groups. In this method, all meaning is situated in a particular perspective or context and since different people and groups often have different perspectives and contexts, there are many different meanings in the world.

It was decided to specifically follow a qualitative research method, as such a method involves a collection or a variety of empirical material, such as personal experiences that

describe routine and problematic moments and meaning in individual's lives. This viewpoint is endorsed by Brink (1996:119) who explains that qualitative research is concerned with how people make sense of their lives.

Another reason why a qualitative approach was chosen for this study is that such an approach is usually used to explore areas about which little is known and to gain information about phenomena such as attitudes and thought processes that are difficult to extract through mere conventional research methods, as indicated by Strauss and Corbin (1998:11).

Neuman (1997:420) also states that data obtained through qualitative research is rich in detail and capable of showing the complex processes of social life. All of the aforementioned characteristics of a qualitative study convinced me that such an approach would provide the proper framework for this study.

Because of data collection methods and the effort to understand the participants' own perspective in using a qualitative method, a researcher interacts extensively with participants during the study. The researcher wants to understand real-life situations by talking and interacting with respondents through qualitative research methods of interviewing and observation.

It is from this description that McMillan and Schumacher (2001:15) define a qualitative research approach as a research method that presents data as narration. It provides explanations to extend our understanding of a phenomenon, or promotes opportunities of informed decisions for social action. It further contributes to theory, educational practise, policy-making and social consciousness. McMillan and Schumacher (2001:15) furthermore, state that the qualitative approach seeks to establish relationships and causes of change in measured social facts by presenting data in numbers.

Gay and Airasian (2003:13) identified the following characteristics of a qualitative approach.

- Qualitative research seeks to probe deeply into the research setting to obtain in deep understanding about the way things are, why they are that way, and how the participants in the context perceive them.

- In addition to describing the way things are, a qualitative approach also provides insights into what people believe and feel about the way they are.
- Researchers using a qualitative approach maintain physical presence in the chosen setting ranging from being an observer to an interviewer.
- A qualitative approach involves text of written words to document variables as well as the inductive analysis of the collected information.

3.4 Data collection techniques

Data collection is a detailed description of the data gathering procedures for the planned investigation. This description covers the specific techniques to be employed and specific measuring instruments to be used in making the measurement (De Vos 1998:100).

To obtain as complete a picture as possible of every participant's interactions, a variety of techniques were employed. The following qualitative data instruments were used to collect information or data that are valid and reliable from the respondents under study or other relevant material, which provides information on the topic under research: observation and interviews. The following information will also be shown on the data collection matrix (See table 3.2).

Question	Instrument Types		
	Observation	Semi-structured interview	Focus group interview
To what extent did children acquire computer literacy skills through the launching of the Digital Doorway project in Mamelodi?	X	X	X
How did these children acquire computer literacy skills without the guidance of a facilitator?	X	X	X

What is the computer jargon acquired and which computer applications were used?		**X**	**X**
What is the nature of the social interaction between children?	**X**	**X**	**X**

Table 3.2: Data collection matrix

3.4.1 Observations

Marshall and Rossman (1999:107) define observation as a systematic noting and recording of events, behaviours and objects in a social setting chosen for the study.

McMillan and Schumacher's (2001:271) explain that observation is used to describe the data that have been collected, regardless of the technique employed in the study. In a sense, all techniques of gathering data involve observation of some kind. They further explain that observational records that are called field notes are detailed, non-judgmental and are concrete descriptions of what has been observed.

In this study, I visited the CSIR and viewed the videos on which the activities (using the computer and applying various skills) of the children using the Mamelodi Digital Doorway project were recorded. To administer this observation, notes were taken in the form of a diary, recording each day's activities.

3.4.2 Interviews

Interview is used in this study as the second method of collecting data. The researcher of this study employed interviews because it is a method of gathering information that involves direct personal contact with the participant who is asked to answer questions (Bless & Higson-Smith 1995:106). An interview is a two-person conversation initiated by the interviewer for the specific purpose of obtaining research-relevant information and in which the researcher focuses on content specified by research objectives of systematic

description, production or exploration. It involves the gathering of data through direct verbal interaction between individuals (Cohen, Manion & Morrison 2000:260).

Holstein and Gubrium (2003) describe interviewing in qualitative studies as a unique form of conversation, which provides the researcher with empirical data about the social world, simply by asking participants to speak about their lives.

Marshall and Rossman (1999:109) define interview as

> *…a conversation with a purpose; it is a useful way of getting large amounts of data quickly.*

Cates (1985:97) identified few advantages and disadvantages of interviews. He mentions that:

> *The major advantages of the individual interview is that the interviewer can tailor it to the person being interviewed and can utilise both verbal and non-verbal cues in determining the responses.*

Cates (1985:97) adds*, "Its major disadvantage is that data gathering through interviews may be unreliable or inconsistent because of difference in questions or methods employed by the interviewer or because of differing levels of perceptiveness and effectiveness among interviewers."*

On the other hand it is said that there is always the danger of bias in interviews, largely because interviewers are human beings and not machines, and their manner may have an effect on the respondents.

There are different types of interviews, namely structured, standardised, in-depth, ethnographic, elite, life history, focus group and semi-structured (Cohen et al., 2000:271). In this study, the researcher administered semi-structured and focus group interviews to collect data. Interviews were conducted at the Mamelodi Digital Doorway. The researcher was physically present at the learning station to interview children. Responses were recorded with a tape recorder with the full permission and consent of the respondents.

3.4.2.1 Semi-structured interviews

Semi-structured interviews were employed in this study because this type of interview is easy to use as the researcher can decide on the order and wording of the questions even though he or she has prepared the questions beforehand. The researcher can also decide whether follow-up questions should be asked. Grinnell and Williams (1990:215) emphasise the fact that “this type of interview is often used when the study is at the descriptive level”.

The prepared questions for the interview are semi-structured because semi-structured questions have no choices from which the respondent selects an answer. Rather the question is phrased to allow for individual responses. It is an open-ended question but is specific in its intent (Macmillan & Schumacher: 2001:69).

Therefore, the researcher asked semi-structured questions to gain additional information by means of the individual interview and to avoid the possibility of the questions suggesting motivators biasing participants’ answers to the semi-structured questions. Eight (8) children were interviewed at the Mamelodi Digital Doorway kiosk. These questions were asked in the language that participants understood the best, that is Sesotho as it is the language that some of the community members use. After the interview, a neutral body was consulted in order to check translation into English.

Interviews are used to verify information obtained by other means, for probing in problem areas, and for obtaining reliable, first hand information. "The question must be asked person-to-person if we want it to be answered fully" (Fontana & Frey 1994:374).

A benefit of conducting semi-structured interviews is that it enables the researcher to gain participants’ cooperation by establishing a relationship with them, which therefore facilitates the production of high response rates (Leedy & Omrod 2001). Within this study, establishing such relationships should enable the researcher to gain more information and generate more data.

This type of interview is also called an unstructured interview where the format may consist of a list of open-ended questions that introduce the interview. The exact content

of the interview itself changes from one respondent to another, where additional questions are formulated during the interview to follow interesting leads of respondents.

The interviewer audiotaped all interviews and used handwritten notes to support the recordings. These assisted her with the transcriptions for analysis purposes. Observations were noted during the interviews, especially with regard to non-verbal cues.

For this study, the interviewer wants respondents to give information about their experiences and feelings or attitudes towards a certain social element in a learning station. Some ethical considerations must be taken into account when using interviews: informed consent, assurance of confidentiality and anonymity.

The respondents' permission to use a tape recorder was established beforehand. They gave their full consent without pressure. The respondents were also assured that the information they gave would be treated as highly confidential and it would not be divulged to anyone who is not involved in the research. Their names would also not be made known to anyone and they would remain anonymous throughout the study.

The research relies entirely on the information given by respondents during interviews for findings and conclusions. Therefore, it is important to make sure the interview process is effective and reliable.

3.4.2.2 Focus group interviews

Focus group discussions are in-depth interviews whereby a limited number of interacting individuals with common characteristics relevant to the study topic are used to elicit information that could not be obtained through other methods of data collection (Chamane & Kortenbout 1996:23-25). Focus group interviews are used as a self-contained method of data collection (De Vos et al. 2002:207).

The main purpose of the focus group interview is to collect data about the personal experiences of participants. According to Morse (1994:226), focus group interview technique with "proper guidance from the interviewer can describe rich detail of complex experiences and the reasoning behind...actions, beliefs, perceptions, and attitudes."

The focus group interview has several advantages. In this study, it was used because:

- Interviewees would be less hesitant to provide information in a group than in a one-to-one situation and that they would cooperate with one another for a limited time.
- Another advantage is that they possibly yield the best information because of the interaction between participants and encourage them to explore their thoughts (Holloway & Wheeler 2002:93).

3.5 Data analysis

According to De Vos (1998:100), Maykunt and Morehouse (1994:127) data analysis is the process through which one understands more about the phenomenon under investigation and describes what one has learnt with a minimum of interpretation. It simply explains the procedures that one will use to analyse the data.

In this case where a qualitative interview is used, data analysis starts after each interview. After completing each interview and again after finishing a large group interview, one examines the data one has collected, pulls out concepts and themes that describe the world of interviewees (Rubin & Rubin 1995:226).

The interview data were coded through a process of grouping interviewee responses into categories that bring together similar ideas, concepts of themes one has discovered. When coding was complete, the data was grouped into categories that allow for comparison of what different children said, what themes were discussed and how concepts were understood (Rubin & Rubin 1995:228).

McMillan and Schumacher (2001:461) define data analysis as primarily an inductive process of organising the data into categories and identifying patterns and relationships among those categories. Most of these categories emerge from the data, rather than being imposed on data before data collection.

In this study data was analysed by describing the description of the interviews obtained from the transcribed information (Graneheim & Lundman 2004:105). Each transcript was read to obtain a sense of the comprehensiveness of the experiences of the participants, classified into categories and codes. Therefore, the data collected during interviews have been analysed and broken down into categories to provide meaning to the findings and conclusions of the study.

For this project, a tape recorder was used during interviews in order to record all information supplied by respondents. Notes were compiled and arranged in files. These notes were reviewed on a regular basis, identified and labelled whenever possible as being related in particular ways to the emergent issues of the study (Jorgenson, 1989:108). A coding strategy of analysing data was employed to identify facts, factors and other important aspects of the study easily. Coding may take several forms such as the abbreviation of key words, coloured dots, numbers or any other form chosen by the researcher (Marshall & Rossman, 1999:152).

Marshall and Rossman (1999:152) identified six phases of data analysis: organising data; generating categories, themes and patterns; coding data; testing emergent understandings; searching for alternative explanations and writing the report.

- **Organising data**

Information recorded during interviews was organised and later analysed. Each child response was organised separately and later compared with the other information received from other children.

- **Generating categories, themes and patterns**

This step makes the interpretation of the information easier for the researcher. Information received was divided into categories and groups to show similarities and differences for easy identification of pattern in the study.

- **Coding data**

The data was then coded for easy interpretation. This stage also required the researcher to identify similarities and differences in the information supplied by respondents.

- **Testing emergent understandings**

This step tests the correct understanding of interpretations by the researcher. Did the respondent understand the question, and does the researcher understand the response? Words that are difficult to understand should be identified.

- **Searching for alternative explanations**

Some words or responses might not be easy to understand. In this case, the researcher must initiate alternative ways of interpreting and understanding responses.

- **Writing the report**

After all the endeavors to try and make sense of the recorded materials, it is time to compile and write the report on the findings and conclusions of the study.

All these phases served as a guideline for this project to analyse the findings successfully and come to proper conclusions of the study.

3.5.1 Guidelines for data analysis

The researcher should be attentive to words and phrases in the respondents' vocabularies that capture the meaning of what they do or say. The respondents might use different or unfamiliar phrases or words that describe their situations; therefore it is very important for the researcher to understand these words and phrases. Whenever the theme in one's material is noted, acts and statements should be compared with one another to establish whether there is a concept that could unite them (De Vos 1998:337).

In this study the researcher, when analysing data, looked for underlying similarities as well as differences between the themes and categories that were identified after data had been collected.

3.5.2 Unit of analysis

The unit of analysis was the narrative descriptions of the case study that were obtained from the transcribed information of the interviews (Graneheim & Lundman 2004:105). Each transcript was read to obtain a sense of the comprehensiveness of the learning experiences of the participants. The following steps were followed in the unit of analysis:

- **Step 1**

After the transcription of interviews, the researcher went through all the transcripts to code data accordingly.

- **Step 2**

The data were then divided into units of meaning given by respondents. All similarities were highlighted with one colour, and then grouped together on a page. Differences were also highlighted with another colour and grouped on their own page.

- **Step 3**

The researcher then identified different categories by identifying them from direct responses to questions asked during interviews**.**

- **Step 4**

Units were matched and utilised in general categories. Understanding of questions according to categories was established during the interviews. These categories were classified into four, namely, computer literacy, usage of computer, computer jargon and computer programs used.

- **Step 5**

The researcher refined the categories to check if one unit of data could be placed into more than one category. Some questions were grouped together under one category as they explain more or less the same thing.

- **Step 6**

Finally, all data were coded respectively to their categories. From the codes, findings and conclusions could be made for better understanding of the study.

3.6 Trustworthiness

The term “trustworthiness” refers to the way in which the inquirer is able to persuade the audience that the findings in the study are worth paying attention to and that the research is of high quality (Lincoln & Guba in Johnson & Turner 2003).
To achieve this goal, the work must be rigorous in terms of validity and reliability. Guba (1981) and Lincoln and Guba (1985) talk of trustworthiness as the general issue, with credibility (akin to internal validity), dependability (akin to reliability) and confirmability (akin to objectivity) as aspects of creating trustworthiness.

To prove the trustworthiness of research, the researcher has to search for negative evidence, search for rival explanations, look beyond dramatic evidence, link one’s findings and conclusions to both data and theory, conduct coding checks and report details (Westphal 2000:x).

3.6.1 Validity

Barbie (2001:143) explains validity as the extent to which an empirical measure adequately reflects the real meaning of concepts under consideration. According to Wilkinson (2000:42) validity relates broadly to the extent to which an instrument measures what it aims to measure, what it claims to measure or test what it is intended to test.

The research methodology for this study project strove to establish the validity of findings by providing and reflecting the real meaning of Minimally Invasive Education (MIE) as practiced at the Mamelodi Digital Doorway project. To ensure that valid and reliable meaning is constructed from the research data gathered, a number of measures were implemented for internal and external validity. Slavin (1984:12) outlines the difference between internal and external validity as follows:

3.6.1.1 Credibility (Internal validity)

Mayan (2001) describes internal validity as the accurate presentation of a particular context or event as described by the researcher. Durrheim and Wassenaar (2002:64) refer to credibility as the assurance that the researcher's conclusions stem from the data.

The researcher established credibility by applying triangulation to the methods of data collection and data analysis, in order to determine if there were any discrepancies in the findings. The researcher strove to produce findings that are believable and convincing, also presenting negative or inconsistent findings in order to add to the credibility of the study. She had the questions assessed by her supervisors to ensure that they are adequate for measuring what they are supposed to measure, therefore ensuring content validity.
According to Johnson (1997) in qualitative research three types of validity can be discussed: descriptive validity, interpretive validity, and theoretical validity.

- **Descriptive validity**

Descriptive validity refers to the factual accuracy of the account as reported by the qualitative researcher.

- **Interpretive validity**

Interpretive validity is obtained in terms of the degree that the participants' viewpoints, thoughts, intentions, and experiences are accurately understood and reported by the qualitative researcher.

- **Theoretical validity**

Theoretical validity is obtained in terms of the degree that a theory or theoretical explanation developed from a research study fits the data and is therefore credible and defensible.

3.6.1.2 Transferability/Generalisability (External validity)

According to Durrheim and Wassenaar (2002, in Manzo 2005:111) generalisability is the degree to which generalisation can be made from the data and context of the research study to the wider population and settings.

Generalisability is regarded as the way in which the reader is able to take the findings and transfer them to other contexts (Creswell 2003; Mayan 2001 in Manzo 2005:111).

For the purpose of this study, the researcher used rich descriptions of the participants and contexts by supplying a large amount of clear and detailed information about the children's views regarding their computer usage to ensure transferability

This study, therefore, tries to investigate and describe in detail, clarify and explain what happens when children are working in the minimal human interactive environment. The aim is to provide for their interaction, and the choices they make.

3.6.2 Dependability (Reliability)

> *Dependability refers to the degree to which the reader can be convinced that the findings did indeed occur as the researcher says they did"* (Durrheim & Wassenaar 2002:64).

To achieve this technique, the researcher triangulated all data collected during the research process, including the results of the semi-structured interviews and the focus group interviews and the observation of the video material, in order to search for common themes and to provide reliable findings.

Therefore, research can be labelled reliable if the findings and results can be the same and repeated in one way or another.

3.7 Ethical considerations

Ethics is a set of moral principles that are suggested by an individual or group, are subsequently widely accepted and offer rules and behavioural expectations about the most correct conduct towards experimental subjects, and respondents, employers, sponsors, other researchers, assistants and students (De Vos 1998:240).

Ethical guidelines are standards and the basis upon which the researcher ought to evaluate his or her own conduct. Ethical principles need to be internalised in the

personality of the researcher to such an extent that ethically guided decision-making becomes part of his or her total life style. The researcher in this research abided by the following ethical issues: voluntary participation, confidentiality and anonymity, and securing data.

The following ethical principles were adhered to in this study: voluntary participation, informed consent, confidential and anonymity.

- **Voluntary participation**

The participation of children in this study was completely voluntary and fair in the sense that they selected themselves. Brink (1996:40-42) explains the principle of fair treatment as the participant's right to fair selection and privacy. Before each interview, written informed consent was obtained from participants' parents. The principles of voluntary participation according to Trochim (2001:24) require that people should not be coerced into participation in research. Subjects need to participate voluntarily and without any pressure or manipulation.

- **Confidentiality and anonymity**

Confidentiality and anonymity are two standards that help to protect the privacy of research participants (Trochim 2001:24). According to Farnham and Pilmlott (1995:48), confidentiality is an active attempt to remove from the research records any elements that might indicate the subject's identities while anonymity means subjects remain nameless. Trochim (2001:24) indicates further that participant confidentiality assures the participants that identifying information will not be made available to anyone who is not directly involved in the study. Anonymity is a stricter standard that means that the participants will remain anonymous throughout the study, even to the researchers themselves.

- **Securing data**

The researcher must take intentional precautions to ensure that information does not accidentally fall into the wrong hands or become public. Precautions should be taken to ensure that research-related information is not carelessly discussed (Farnham & Pilmlott 1995:48).

3.8 Content validation of the interview schedules

To gather as much data as possible, the following interview questions were pre planned and asked during the interviews. Table 3.3 illustrates the summary of the questions planned prior to the interviews.

What I want to know	Main question to be asked	Possible probing questions	What I want to achieve
What children know about the computer.	What do you call this object?	Can you tell me anything that you know about it?	Children's computer knowledge
Whether children can use the computer.	Are you computer literate? Where did you learn to operate this computer?	How best can you work on a computer?	Level of children's computer literacy.
How children acquired the computer literacy skills.	Have you ever used the computer before?	Where did you first use it, and who helped you?	To find out the means used by children to acquire the computer literacy skills.
Which computer jargon is used.	Which programme do you use?	Can you describe how you use this computer?	Determine if children use the relevant jargon.
Whether learning takes place.	How often do you use this computer?	What do you use it for?	Children learn minimally or differently.
The nature of the social interaction between children.	Do you normally get a turn to use this computer?	How possible is it to use one computer in groups?	To identify the learning methods used.
Whether the computer is of importance to children.	Do you like this computer?	What interests you about this computer?	To find out if more computers be installed in South Africa.

Table 3.3: Summary of the questions planned prior to the interviews.

3.9 Conclusion

In this chapter, the research design, research methodology and process were discussed. The research paradigm, methods of data collection and data analysis, measures for ensuring validity and reliability, as well as the ethical considerations were carefully explained. Tables were used to illustrate and enhance understanding of the research design. The following chapter, Chapter 4 looks at the data analysis and findings of the research.

CHAPTER 4: ANALYSIS AND INTERPRETATION OF THE VIDEO-TAPED OBSERVATIONS, PERSONAL AND FOCUS GROUP INTERVIEWS

4.1 Introduction

In this chapter, the researcher provides the reader with a factual account in a descriptive format of the data collected at the Digital Doorway installed in Mamelodi. Discussion is based on the data collected through the video-taped observations, individual and focus group interviews.

4.2 Results of the video-taped observations

The study is conducted by observing videos in MPEG format on a computer. The researcher visited the CSIR for a period of three days to observe the videotapes. These videotapes captured the activities that took place at the Mamelodi Digital Doorway projects. The researcher managed to observe only the activities that ran for two weeks (from 12-19 December 2003).

Each video covers a period of one hour. It is stored under a name consisting of the date as well as the time of the recording. The sound on the video is mostly inaudible; therefore it makes it difficult for the researcher to link the action to words.

The aim of observing these videotapes was to gather enough data that would answer the following research questions:

- To what extent did children acquire computer literacy skills through the launching of the Digital Doorway project in Mamelodi?
- How did these children acquire computer literacy skills without the guidance of a facilitator?
- What is the nature of the social interaction between children?

4.2.1 Coding of the observations captured on videotape

Analysis of the video-taped observations is presented in a table showing categories, descriptions and codes. Below the tables a discussion of the video-taped observations is presented.

The following codes will explain the transcription of the video-taped observations:

- Time frames and rate at which the computer was used.
- Group size and composition, leadership and pecking order.
- Duration of visiting and using the computer.
- Computer skills and knowledge observed.
- Social interaction between users.
- Learning techniques that became apparent.

4.2.1.1 Time frames and the rate at which the computer was used

Table 4.1: Coding system regarding the time frames and the rate at which the computer was used.

Category	Description	Code

Time frame at which the computer was used.	The computer was used before 10H00 in the morning and after 17H00 in the afternoon. Young adults visited the kiosk in the morning. As the day went on, more teenagers frequented the room. Early in the morning, children visited the computer.	RO1 RO2 RO3 RO4
The rate at which the computer was used.	People popped in all the time and looked at the computer. More teenagers and children visited the kiosk all the time.	RC1 RC2

4.2.1.2 Group size, leadership and pecking order

Table 4.2: Coding system regarding group size and composition, leadership and pecking order.

Category	Description	Code
Group size and composition.	A group of three children, one adult and a security guard visited the kiosk. A group of teenagers and one child visited the kiosk. A child and a teenager were seen in the computer room. An adult and a teenager later joined the active teenager. Two women and a security guard visited the computer room. A group of five children and a security guard were seen in the kiosk. A boy and a girl visited the kiosk. Two adult women and one male visited the computer room. Four adult males visited the kiosk.	GC1 GC2 GC3 GC4 GC5 GC6 GC7 GC8 GC9

	Three children visited the computer room. Two young women visited the computer room. A group of eight children was seen in front of the computer.	GC10 GC11 GC12
Pecking order	Young adults visited the kiosk in the morning. More children were seen during the day. During the afternoons more teenagers frequented the room.	PO1 PO2 PO3
Leadership	The “know how” children became leaders and taught others. Teenagers mostly took a lead and younger children became spectators.	LK1 LK2

4.2.1.3 Duration of visiting and using the computer

Table 4.3: Coding system regarding the time spent in the kiosk and the activities that took place on the computer.

Category	Description	Code
Time spent in the kiosk.	Women left after few minutes. A boy was in front of a computer for a long time. A group of teenagers stayed approximately two or more hours. A group of children stayed longer and seemed shouting and excited.	DT1 DT2 DT3 DT4
Activities on the computer.	People looked behind and around the computer, then touched it. Adults who pass by entered the room and press some keys. Teenagers would look, try something and go away. When teenagers left, one of the women start using the computer.	AD1 AD2 AD3 AD4

	Children also pressed the buttons.	AD5

4.2.1.4 Computer skills and knowledge observed

Table 4.4: Coding system regarding participants' computer knowledge and skills.

Category	Description	Code
Computer knowledge.	It showed that one of the teenagers knew how to use a computer.	CK1
Computer skills.	One of the children started to play games on the computer.	CS1

4.2.1.5 Social interaction between users.

Table 4.5: Coding system regarding the social interaction between the computer users.

Category	Description	Code
Social interaction between users.	Children and teenagers talked but seemed uninterested in the computer.	SI1
	The security guard showed the women something on the computer.	SI2
	One of the teenagers would press buttons while others watched and became spectators.	SI3
	Two young women worked together on the computer.	SI4
	The security guard showed children a few things as they stood together around the computer.	SI5
	The boy helped the girl to do something on the computer.	SI6
	The teenager pressed the buttons while the child looked on.	SI7
	Two adult women joined two teenagers on the	SI8

	computer. Child X and child Y worked together on a computer. A teenager and child X discussed a while. After some time the teenager started to press the buttons. Children flocked together in front of the computer. The teenager with other children took turns in front of the computer in a friendly manner.	 SI9 SI10 SI11 SI12

4.2.1.6 Learning techniques that became apparent

Table 4.6: Coding system regarding the observed learning.

Category	Description	Code
Incidental learning or discovery learning.	A teenager started to press some buttons and got some pictures on the computer. One of the children who was in front of the computer got something to work on and they were excited. Child X discovered a game while trying to do something on the computer.	LA1 LA2 LA3
Cooperative learning and collaborative learning.	One of the children who had never used the computer before was seen in front and it showed that he had clearly seen and learned enough by watching. Child X had to help at times. Other children also tried to use the computer with child X telling them what to do.	CL1 CL2 CL3

4.2.2 Discussion of the video-taped observations

The main findings of the video-taped observations are discussed under the following categories.

4.2.2.1 Rate at which the computer was used

Observations show that the users frequently visited the computer and the kiosk was seldom seen empty. This is indicated by codes “RC1” where people were observed visiting the kiosk all the time and “RC2” where teenagers and the number of children increased in the kiosk all the time.

The rate at which the computer was used increased time and again. This was evident where the users were observed visiting the kiosk frequently in different times. This is indicated by the codes “RO2” where young adults visited the kiosk in the morning, “RO3” during the day more teenagers frequented the room, and “RO4” early in the morning, children visited the computer.

Adults, especially males, were mostly seen in the early hours of the morning before going to work and also in the evening. The computer was seldom used after 18H00. This might be due to the reason that the municipality offices were closed and many people were no longer present in the vicinity. People may be afraid of intimidation and crime after the sunset.

4.2.2.2 Group size

The size of the group ranged from five to eight with a mixture of age groups, that is, teenagers, adults and children.

Small children, especially boys, were the most common participants. Before knowing and becoming familiar with the computer, their group formation mainly consisted of one to four members. This is indicated in code “GC1”where a group of three children, one adult and a security guard were observed in the kiosk. As they became familiar with the computer, the group size increased from four to ten.

In terms of leadership it was observed that the ‘know how’ children became leaders and taught others how to use the computer. If the group consisted of teenagers and children, teenagers would take a lead and run the show while younger children became spectators.

There is a definite pecking order at the Mamelodi Digital Doorway project. This seems to be adults, children and then teenagers. This view is evident where young adults visited the kiosk in the morning (PO1), children were seen during the day (PO2) and teenagers frequented the room during the afternoons.

4.2.2.3 Duration of visiting and using a computer

Two sets of groups were observed at the kiosk, for an example, one, which would stay long, and another, which would stay a short period. A group stayed shorter period, for an example, five to ten minutes. This may be due to the reason that they were either not sure of what they were doing or bored as they did not get a chance to use the computer. Normally if a group of children was using the computer and teenagers arrived, they would go and play outside, and then came back after the teenagers had left the kiosk. A group might stay long, approximately one to two hours depending on the activity that interested them. This group normally consisted of the ‘know how” children and the “know not” children. The “know nots” were mostly passive, but some of them would learn by either imitating or being helped by their peers.

Activities done on the computer differed according to the need and interests and knowledge of the users. Mostly, as some of the users lacked computer knowledge, they spent time pressing buttons trying to do something on the computer.

4.2.2.4 Computer skills and knowledge

Observations show that some of the computer users possessed computer skills and knowledge. This was also mentioned in section 2.2 where groups consisted of the “know how” and the “know not” children. The “know how” children always used their knowledge to play with the computer whereas the “know nots” became spectators.

Brown (2000) describes knowledge as an essential commodity which learning must strive for. He mentioned that knowledge has two dimensions, the explicit and tacit. The explicit dimension deals with the concept “know-what” whereas the tacit deals with “know how”, which is best manifested in work practises and skills. Tacit lives in action, it comes alive in and through doing things, in participation with one another in the world. Tacit knowledge can be distributed among people as a shared understanding that emerges from working together.

Brown (2000) further mentions that much of knowing is brought forth in action through participation in the world, with other people, around real problems. Much of our know-how or knowing comes into being through participating in our community of practise.

4.2.2.5 Social interaction

Social interaction between the computer users was observed whereby users interacted mutually in the use of a computer. Observations show interaction between children and teenagers, adults and teenagers and amongst children themselves. This is evident where the security guard showed children a few things on the computer (SI 6) and where child X and child Y worked together on a computer (SI 3).

Socio cultural theories (Engeström 2000, Toomela 2000, Soini 1999, Weinger 1998, Jarvilento 1994) cited by Brown (2000) emphasise that any human activity cannot be understood separately from its environment and particularly from its cultural (social) context. McCarthy (1996) cited by Brown (2000) explains that social is not only an aspect, but also the environment of the human being.

The social theories of learning integrate the component necessary to characterise social participation as a process of learning and knowing: meaning, practise, community and identity (Brown 2000).

4.2.2.6 Learning techniques

Observation has shown that incidental and cooperative learning take place all the time. Incidental learning was observed where child X discovered a game while trying to do something on a computer (LA 3), while cooperative learning took place when children tried to use a computer with child X telling them what to do (CL 3).

4.3 Results of the individual semi-structured interviews

Semi-structured interviews were conducted at the location of the Mamelodi Digital Doorway where individual participants were interviewed**.** The target group consisted of eight boys between the ages of five and twelve who participated in the investigation over two weeks.

The researcher deemed it vital to conduct individual semi-structured interviews to explore what the target population was capable of doing on the computer at the onset of the research project. This enabled her in answering the following sub-questions cf. (Chapter 1, heading 1.4 page 17).

Each individual analysis is presented in a table showing categories, descriptions and codes allocated to the different responses. Below each table a brief summary of quotations obtained from the transcripts of individual interviews is presented.

The following codes explain the coding of the transcriptions of the individual semi-structured interviews.

4.3.1 Coding of the responses of the respondent who participated in the individual interviews

From the analysis of the individual semi-structured interviews, the following main categories were identified following the coding of the respondents' transcribed responses in terms of the main research questions and interview questions (See chapter 3, paragraph 3.8):

- Computer knowledge, skills and terminology.
- Computer applications and websites used.

- Function or use of a computer.
- Computer literacy, place of study and the method of study.

4.3.1.1 Computer knowledge, skills and terminology

Table 4.7: Coding system regarding respondents' computer knowledge, application skills, and terminology.

Category	Description	Code
Computer knowledge.	If you type something here, you cannot print it.	KC1
	I browse the Internet and get straight to the Web.	KC2
	You simply press the touch pad and click the program.	KC3
	One of my friends knows how to play games.	KC4
Computer skills.	When you look for something you type www.something.	CS1
	If it's not what you want, you click delete and start again.	CS2
	I saw them writing the same words that I saw on the newspaper.	CS3
	If you don't want it, you close it, and open another one.	CS4
	I was here with my friends playing on the computer.	CS5

Computer Terminology.	This is called a computer. It is an Eskom computer. I can still say it is an Internet. There are also some speakers. Computers at my school are divided into four parts, there is a keyboard, mouse, screen and a monitor.	CT1 CT2 CT3 CT4 CT5

In relation to the category ‘computer knowledge’, respondents showed that they possessed basic computer knowledge. This is evident where five respondents indicated their acquaintance with components associated with the computer (computer knowledge) such as using word processor: (typing) and browsing the ‘Net’.

The term ‘knowledge’ is used to mean the confident understanding of a subject, potentially with the ability to use it for a specific purpose (http://en.wikipedia.org/wiki/knowledge). For the purpose of this project, the researcher will use the term ‘knowledge’ to explain the confident understanding of computers’ potential with the ability to use it for a specific purpose.

Today, most people realise that knowing how to use a computer, especially a personal computer, is a basic skill required to function effectively in society. Given the increasing use and availability of computer systems, computer proficiency will continue to be an essential required skill in future (Shelley, Cashman, Waggoner & Waggoner 2000:1-2).

Bruner in Papert (1980:95-96) talks about the influential classification of ways of knowing. In his explanation, he mentions that some knowledge is represented as action, some as image, and only the third category as symbols. He asserts that ‘words and diagrams’ are important to represent certain kinds of knowledge, which is only representable as action.

Hannafin and Peck (1988:49) stress the importance of prior knowledge in learning and believe that learning may be more efficient when the instruction is adapted to the needs and the profiles of individuals. In contrast, Cunningham (1991:26) argues that knowledge

is constructed, not only in the light of the existing knowledge and experience of the learner, but also the societal and cultural content in which it is placed.

According to the American Heritage Dictionary of the English Language (2004), two definitions of skill are given:

- Skill is a proficiency, facility, or dexterity that is acquired or developed through training or experience.
- Skill is an art, trade, or technique, particularly one requiring use of the hands or body.

In relation to the category computer skills, respondents mentioned quite a number of skills they possessed. These are evident where three respondents indicated that they ‘could click various programs they like”, only one out of eight respondent could save his work on the programme “my document”, delete and start the programme, and could also open and close the programs.

Tapscott (1998:107) explained that N-Genes (an acronym for the Net Generation – described as a generation of children that have been raised with computers from infancy) are actually developing skills at an earlier age than their parents’ generation. They have a new medium to reach out beyond their immediate world, to experience and to engage in play, learning and overall social intercourse.

Harel (2004) supports this view by highlighting that today’s ‘tech-savvy generation of children’ who are light years ahead of their parents when it comes to the use of new media, were using computers almost before they could talk, and can find virtually anything – from music to movies to games – on the Internet. He further explains that there is a fundamental set of new media-literacy skills that all children should be expanding. Activities on the site are meant to help children develop the three X’s: exploration, expression, and exchange of ideas and creations with digital media and technology tools.

Papert (1980:96-98) points out that one of the kinds of learning that many people believe to be the best is done by ‘just doing it’ – the learning of physical skills. Papert

(p, 98) cites Gallwey's book "Inner Tennis" where he offers some suggestions for the way out of learning. Gallwey encourages the learner to think of himself as made up of two selves: an analytic, verbal self and a more holistic, intuitive one. He argues that now one and now the other of these two selves should be in control; in fact, an important part of the learning process is teaching each 'self' to know when to take over and when to leave it to the other.

Responding to the category computer terminology, respondents proved that they have knowledge of computer terminology. This is evident where four respondents mentioned that the object is called a computer, whereas two out of eight respondents mentioned that the object is an Internet and also two out of eight respondents could mention that the object has parts, namely keyboard, mouse, screen, monitor, speakers and printer.

According to Papert (1980:98) in a computer-rich world, computer languages that simultaneously provide a means of control over the computer and offer new and powerful descriptive languages for thinking will undoubtedly be carried into the general culture. They will have a particular effect on the language for describing one's self and learning.

To sum it up, it is evident that children at the Mamelodi Digital Doorway project acquired computer skills such as opening and closing the programs. Children learnt cognitively in acquiring these skills because cognitive learning is associated with thinking and knowing – the skills required for children to understand language and number, to reason and problem solve, and to learn and remember (http://www.effectsoncognitive.htm).

For the purpose of this research, cognitive learning focuses on the development of a specific set of visual skills crucial to the use of computer technology; special skills, iconic (or image representation) skills, and visual attention skills. Computer applications of many kinds, and especially computer games, are designed in ways that emphasise visual rather than verbal information processing (http://www.effectsoncognitive.htm).

4.3.1.2 Computer applications and websites used

Table 4.8: Coding system regarding respondents' usage of computer applications and websites.

Category	Description	Code
Computer applications used.	I normally use the Internet. Playing music. I play games and listen to music.	PU1 PU2 PU3
Websites used.	I once visited www.gov.za. I visited education sites. When you look for something like games you type www.something (sic!).	WV1 WV2 WV3

In relation to the category computer applications used, respondents mentioned similar applications they used at the Mamelodi Digital Doorway kiosk. This is evident where two respondents indicated that they use the Internet, while four respondents use education sites, and two respondents use music and game applications respectively. This is in line with the utterance of Attwood (1993:54-55) when he explains computer applications as an art that allows one to design and draw pictures. The package offers one a brush facility, which allows users to draw freely. Users can build shapes with straight lines or use previously stored designs or outlines. They can edit their design by changing the size or colour of items or filling areas with patterns; they can also move or turn shapes. Text can be added in a variety of fonts, sizes and styles.

An example stated by the two respondents about the use of the Internet application is supported by Harel (2004: x) when stating that good Internet learning tools are just like a paintbrush or building blocks. He further explains that web experiences for children should be about learning by doing within a multidimensional creative process, rather than being confined by linear stories or questions and answers.

This view of computer applications is also emphasized by Cronjé (1993:23-24) when he explains that programs such as 'Story Maker and Story Tree' allow children to create their own stories, while a text-based adventure game such as 'Zark' (Infocom) allows children to navigate their own way through a given story. The basis of most reading

programs focuses on word recognition and meanings of words. Programs such as 'Stricky Bear Reading' (Weekly Reader) and 'Reader Rabbit' (Broderbund) require children to match pictures and words or to complete words by typing in missing letters.

Responding to the category "website visited", respondents mentioned that they visited websites like www.gov.za; some visited educational sites while others visited the game sites.

A website or web site is a collection of web pages consisting of documents accessible via the World Wide Web (WWW) on the Internet; the pages of a web site can be accessed from a common root URL, the home page, and usually reside on the same physical server (One Look Dictionary Search n.d).

According to Grobler (2004:3) one of the best ways to search for new information, if one has access to a computer, is by using the World Wide Web. The Internet is a recognised tool to promote constructivist learning. It provides an adequate level of curiosity that promotes learning among children.

Flowing from Grobler's view of using the World Wide Web, Alexandrou (2002:xi) explains the following web categories:

- **Brochure sites**

The purpose of this site is to act as an extension of a company's sales and marketing efforts. It provides information to prospective buyers or clients in the hope that the company will be contacted by e-mail or telephone for more information.

- **E-commerce site**

The primary purpose of this site is to sell goods; a well-known example is Amazon.com. Visitors to these sites know what they want and the e-commerce site helps them to find it and also shows the user information about other products.

- **Communities**

Communities bring together people who share a common interest and may sometimes also sell products and services.

- **Portals**

The purpose of a portal is to provide relevant information to the user without the user having to spend a lot of time searching for it. Ideally the information is tailored to the users' needs.

- **Search engines**

The purpose of a search engine is to find anything that is available on the World Wide Web with a few mouse clicks.

According to Tapscott (1998:32), today's children access the web primarily through browsers. The responsibility is on the child to find information – to manually search for content, which is trustworthy, appropriate, desire and fun. Children control much of their world on the Net. It is something they do themselves, they are users, and they are active. They do not just observe, they also participate. They inquire, discuss, argue, play, shop, critique, investigate, ridicule, fantasise, seek and inform. On the Net children must search for, rather than simply look at information. This forces them to develop thinking and investigative skills (Tapscott 1998:25-26).

Children are not scared of making mistakes (Garson 2003). However, they expect to be able to do something (Harel 2003) and to have fun whilst interacting with the websites and online material. These South African children's actions did not differ significantly from those described in the Clickerati (Harel 2003) and the Net Generation (Tapscott n.d). From section 4.3.1.2 it is evident that children can engage in Web-based programs and have much fun without being experts or frequent users.

The research findings have shown that children learnt basic operations on the computer for browsing the Net. Microsoft and Internet Explorer were the most commonly used applications.

4.3.1.3 Function or use of a computer

Table 4.9: Coding system regarding respondents' use of a computer

Category	Description	Code

Use of a computer.	I look for sales in different shops.	FU1
	I come to play games with my friends.	FU2
	When you type the address you get the information.	FU3
	Look for careers.	FU4
	Complete Science projects.	FU5
	Look for budget speech.	FU6
	Listen to music.	FU7

In relation to the function or use of a computer, respondents indicated that they use a computer for a number of applications and or reasons. The various applications indicate that schoolwork is the major application, while entertainment and looking for other information are respectively second and third in importance.

Children use computers for what goes hand-in-hand with traditional childhood activities. They use technology to play, learn, communicate and form relationships, as children have always done (Tapscott 1998:86). Russell (2002) adds to this notion by indicating that different groups of youngsters, aged seven to sixteen, were actively involved in the kiosk from early morning until dusk. The kiosk was mostly used for typing letters, paging through the Internet, drawing with Paint and playing games.
Papert (1993: IV) supports the above view by indicating that what children do with the computer is as varied as their activities. The greatest amount of time is devoted to playing games. They use computers to write, to draw, to communicate and to obtain information. Some use computers as a means to establish social ties, while others use them to isolate themselves. Respondents had the most fun at the Digital Doorway with their friends. They used the computer for several activities such as entertainment, completing their homework and assignments and for learning new things.

4.3.1.4 Computer literacy place of study and how the computer was studied

Table 4.10: Coding system regarding the respondents' computer literacy, place of study and how the computer was studied

Category	Description	Code
Computer literacy.	I studied computer as part of my studies at school.	CL1
	I learned the computer at home.	CL2
How studied.	I looked at how my friends press the computer; I imitate and sometimes press with him.	LA1
	I saw other people using the Internet, and practised.	LA2
	I saw on the newspaper, and then practised.	LA3
	I looked at how my aunt operates it, and then I practised.	LA4
	My teacher at school taught me.	LA5

In relation to computer literacy, four respondents indicated that they were computer literate as they studied computer at school and at home, while four respondents indicated that they were not computer literate because they only looked at how other children used the computer.

According to Attwood (1993:5) the term “computer literacy” is derived from a wide use of the term “literacy” as in “reading literacy”, “math literacy,” and “science literacy”. Literacy in general is one of the words that almost everybody defines differently. Often the implicit definitions used, reflected by what kind of courses the individuals teach under such titles, are very limited. Furthermore, a great number of variables may affect what type of literacy one is talking about – who the individuals are, the level of literacy required, the objectives of the program. Attwood further described computer literacy as a composite term derived from the general term “literacy” as applied, among other areas, to being able to read and write in a competent fashion, being able to do essential arithmetic and understanding science in general sense (Attwood 1993:5).

Responding to the category “how the computer was studied”, three respondents indicated that they learned to use the computer at school as part of their studies. Only two respondents indicated that they had learned it at home by imitating their members of

the family, whereas four respondents indicated that they learned using it by observing, imitating and practising what they saw other children do at the Digital Doorway.

Shelley, Cashman, Waggoner and Waggoner (2000:1-2) mentioned that children with low computer literacy always work with those with reasonable to high literacy so that they can be given help quickly. Children who have problems with the computer ask for and receive more help from their peers and they will therefore feel secure and less isolated.

According to Tapscott (1998:87 and 134) this generation is curious because they show curiosity. He explains that childhood is all about exploration, discovery and investigation. Baggot in Tapscott (1998:87) supports this idea by indicating that these children can find what they want and what they need quickly, easily and honestly. He further indicates that children rely on one another for learning. Children teach themselves and they can probably teach their teachers as well.

The research findings have shown that the kiosk is mainly used by children about 5 to 12 years old. Children memorised the entire procedures for doing something, for an example, how to open a program and retrieve a saved picture.

4.3.1.5 Interaction between children

Table 4.11: Coding system regarding respondents' interaction with other children

Category	Description	Code

Interaction between children.	We wait for others to complete their work.	IC1
	We give one another a chance.	IC2
	We share the computer.	IC3
	We work together.	IC4
	We help those that do not know the computer.	IC5
	We respect one another.	IC6

In relation to interaction between children, it is evident that children work cooperatively with others. This is shown by respondents' views where they indicated that they work together, share the computer, help one another and show the principle of Ubuntu – respect one another.

Garvey (1977:38) explains that interaction between the children takes the form of mutual involvement with objects and direct involvement in one another's play. Children learn how to cooperate and take turns with a playmate in using a computer in complementary sequences, like alternating, leading and following. By doing so, children interact socially and this in turn leads to their cognitive development.

Piaget (1972) supports the above statement by suggesting that cognitive development is a cyclic process involving interaction with new events, materials, propertied and abstractions. He further suggests that interaction with material objects is essential to the development of thinking. "Through interaction with other people, children begin to realise that different individuals see things differently and that their own view of the world is not necessarily a completely accurate or logic one."

Learning organisation theorist Senge (1990) in Tapscott (1998:137) mentions that learning is social and tends to occur in teams. He further mentions that most understanding is socially constructed. Children rely on one another for learning. According to Hannafin and Peck (1988) studies have proved that the act of students learning together and learning from one another, improves the learning result. Learning cooperatively contributes to the student's construction of his or her own knowledge and the development of higher-order thinking skills.

Group learning and sharing of ideas took place at the learning station. Children assisted one another in the use of the computer as a tool in the preparation of assignments and projects. Children formed impromptu classes to teach one another. The group divided itself into the ‘knows’ and the ‘know nots’, much as they did into ‘have’ and ‘have nots’ in the past.

In reality, one discovers that cooperative leaning takes place in constructing the computer literacy skills in a social way. Basically, constructivism views that knowledge is not 'about' the world, but rather 'constitutive' of the world (Sherman 1995). Knowledge is not a fixed object; it is constructed by an individual through her own experience of that object. The constructivist approach to learning emphasises authentic, challenging projects that include students, teachers and experts in the learning community. Its goal is to create learning communities that are more closely related to the collaborative practise of the real world. In an authentic environment, learners assume the responsibilities of their own learning, they have to develop metacognitive abilities to monitor and direct their own learning and performance. When people work collaboratively in an authentic activity, they bring their own framework and perspectives to the activity. They can see a problem from different perspectives, and are able to negotiate and generate meanings and solution through shared understanding.

4.4 Results of the focus group interviews

Focus group interviews were conducted at the Mamelodi Digital Doorway project in order to obtain as much data as possible on what the target population was capable of doing on the computer (See Chapter 3, paragraph 3.4.2.2 for the purpose of the focus group interview). The target group consisted of five boys aged between thirteen and seventeen who participated in the investigation over two weeks.

4.4.1 Coding of the respondents who participated in the focus group interview

Each focus group analysis is presented in a table showing categories, descriptions and codes allocated to the different responses. Below each table a brief summary of quotations obtained from the transcripts of focus group interviews is presented.

From the analysis of the focus group interviews, the following main categories were identified after coding children's responses in terms of the main research questions and interviews questions (See Chapter 3, paragraph 3.8):

- Justification regarding the use of computer.
- Ease or difficulty of computer usage.
- The use of computer.
- Attitude towards the use of a computer.

4.4.1.1 Children's justification regarding the use of a computer

Table 4.12: Coding system regarding respondents' justification for the use of computer

Category	Description	Code
Justification regarding the using of computers.	I like it, it is important to us all.	FC1
	Everyone uses it.	FC2
	It helps us with our schoolwork.	FC3
	We always play games here.	FC4
	It keeps us away from the street.	FC5
	We come here to play music.	FC6
	You can use it at any time.	FC7
	It does not close.	FC8
	It is ready at all times.	FC9
	We do not pay to use it.	FC10

Responding to the category "justification for the use of the computer", most respondents indicated that they like the computer and further gave individual reasons, such as the computer helps with school work (FC3), they play games and music on the computer (FC4 and FC4), the computer keeps them away from the street (FC5). The most important reason they gave for their fondness of the computer was that it is open twenty-four hours (FC8 and FC9), and it is cost free (FC10). Respondents also indicated that

the computer is important to them all. This is evident where one of the respondents mentioned that everyone uses it (FC2), it is free to use, there are no payments required, it is open all the time (24hrs) and they can use it at any time of the day.

Children are prompted by interest and motivation. Malone (1981:469) explains that intrinsically motivating activities provide learners with a broad range of challenge, concrete feedback, and clear-cut criteria for performance. His theory of intrinsically motivating instruction explains that self-regulated learning has three main characteristics:

- First learners find the environment to be intrinsically motivating. They find participating in the activity to be its own reward and do not seek or need external incentives.
- Second, self-regulated learning are metacognitively active. Learners actively engage in planning and goal setting and are able to monitor and evaluate their own learning.
- Thirdly, self-regulated learners are behaviourally active in that they take the necessary steps to select and structure the environment to best suit their own learning styles. Learner control is essential for self-regulated learning.

Malone (1981) also uses the following intrinsic motivators: curiosity, challenge, control and fantasy (See Chapter 2, paragraph 2.4). Children are motivated primarily through curiosity, brought about by a desire to find out what happens if they click on certain areas. They are also motivated by the challenge to complete activities without mistakes.

Jonassen (1990:33) states:

> *The most effective learning contexts are those, which are problem – or case – based and activity-oriented, that immerses the learner in the situation requiring him or her to acquire skills or knowledge in order to solve problems or manipulate the situation.*

The Mamelodi Digital Doorway project's learning station is set up in an outdoor playground setting, which children could access at any time. The playground is appealing to children and conducive to supporting learning as learners can explore in a non-threatening environment. Free and unlimited access attracts children to the learning station. Unconditional access to the learning station ensures that both children in school and out-of-school can use it. The unstructured nature of this setting ensures that children themselves take ownership of the learning station by forming self-organised groups who learn on their own. An unsupervised setting ensures that the learning process is learner centric and is driven by the child's natural curiosity.

4.4.1.2 Ease or difficulty of computer operation

Table 4.13: Coding system regarding the respondents' ease or difficulty to operate the computer

Category	Description	Code
Ease or difficulty of operation.	It was difficult for me to play at first. For the first time I saw it I did not know how it is used. It was easy because my friends know how to play it. It is difficult because there is no one to ask how to play it. It was easier for me, because I learned about computers at school.	ED1 ED2 ED3 ED4 ED5
Mode of operation.	I practise by myself. I look at how they play it. They help me to play it.	MO1 MO2 MO3

In response to the category "ease or difficulty of operation", different responses were indicated. For example, codes (ED3 and ED5) indicate that the respondents found the computer easy to use because their friends know how to play the computer, and the other reason given is that the respondent learned to use the computer at school. Some of the respondents indicated that they found the computer difficult to use. This is evident where respondent mentioned that for the first time he saw it he did not know how to

operate it (ED2) while the other respondent mentioned that it was difficult for him to operate because there was no one to ask if you have a problem (ED4).

Tapscott (1998:40-41) explains that the Net Generation children are born with technology and they assimilate it. With assimilation, children view technology as just another part of their environment, and they soak it up along with everything else. He further explains that the computer and the Internet have become such strong elements of youth culture that sometimes the generation gap is evident even among children who have not been raised around computers.

Piaget (1972) states that children are naturally curious about their world and actively seek out information to help them understand and make sense of it. They continually experiment with the object they encounter, manipulating things and observing the effects of their action.

In response to the category “mode of operation”, respondents indicated that they operate the computer differently. This is shown by some of the respondents when saying that they practise using the computer themselves (MO1); others said that they look at how others operate the computer (MO2), while the last group of respondents indicated that others help them to play with the computer (MO3).

The cognitive approach places an emphasis on active learning because it assumes people learn not only by observing but also by doing. Interaction is important because it does not only maintain attention, but helps create and store new knowledge and skills, and facilitates comprehension (Alessi & Trollip 2001:19).

The research findings show that children using the learning station learned by self-discovery. For example, one child explored randomly in the Graphic User Interface (GUI) environment, others watched until an incidental discovery was made. Several children repeated the discovery by requesting the first child to let them do so. They taught one another shorter procedures for doing the same thing, whenever one of them found a new, shorter, procedure.

4.4.1.3 Importance of using the computer

Table 4.14: Coding system regarding respondent's use of the computer

Category	Description	Code
Use of computers.	I use it to find information for completing my homework and assignments. I use it for several things like…I complete my studies, read news and stars, play music and games.	UC1 UC2

In this category, respondents indicated that they use the computer for various activities, such as studies and entertainment. This is evident where respondents indicated that they use the computer to play games, read news and stars, and listens to music (UC2); and search information for their studies (UC1).

Tapscott (1998:4-5) points out that Net Generations use the digital media for learning and entertainment. They surf the Net in teams or alone to do projects or to look up the stars. He further states that children are learning, developing and thriving in the digital world.

All respondents liked having the Digital Doorway in their area because they visit it for reasons such as completing their homework and assignments, meeting with friends and having fun.

4.4.1.4 Children's attitudes towards using the computer

Table 4.15: Coding system regarding the respondents' attitude towards the computer with reference to care and usage

Category	Description	Code
Care of the computer.	Caretaker must be employed.	AC1
	The computer should be placed inside the yard.	AC2
	Security must be provided.	AC3
	Restrictions for use should be implemented.	AC4
	Entry cards should be used.	AC5
	The room must be locked during the night.	AC6
	Someone has to help with information.	AC7
Negative issues about the computer.	Some of the children watch pornography.	NS1
	Some of the people use it as their bathroom.	NS2
	Some of the people hit the computer when it fails to open.	NS3

In response to the category care of the computer, respondents mentioned various issues that they think might change the situation. This is evident where respondents indicated that a caretaker must be employed (AC1), the computer must be placed inside the yard (AC2), security should be provided (AC3), restrictions should be implemented (AC4), entry cards have to be used (AC5) and the room should be locked during the night (AC6). In addition, some of the respondents replied that someone must be there to assist people who seek information (AC7).

In reply to the category negative issues about the computer, respondents indicated several issues. For example, some of the children accessed pornographic sites (NS1), and some people use it as their bathroom during the night when there are no people around (NS2). Other respondents replied that people overload the computer with information and then hit it when still searching (NS3) as there is no security and the room is left opened all the time.

The research findings show that the learning station can be of more importance and be cared for if training on how to use the Digital Doorway can be maintained and if more computers can be installed and proper location and security provided.

4.5 My personal reflections regarding the use of the Mamelodi Digital Doorway project

Children's daily use of computers is increasing both at school and out of school. Although children still spend more time watching television than using computers, the use of computers is growing rapidly, adding to their total "screen time" (Brown 2000:10-11).

Generally, today's people are realising that knowing how to use a computer, especially a personal computer, is a basic skill required to function effectively in society. Given the increasing use and availability of computer systems, computer proficiency will continue to be an essential required skill in future (Shelley, Cashman, Waggoner and Waggoner 2000:1-2).

The researcher observed that most of the children using the Mamelodi Digital Doorway possess some of these functions, for example, using the Internet in looking for sales and budget speeches. It is therefore assumed that most of them are computer literate.

Although not all children are computer literate and have access to the computer, the concept of 'Minimally Invasive Education' (See Chapter 1, paragraph 1.2) emerged at the Mamelodi Digital Doorway project because children now effectively teach one anothers basic computer skills, and they are also effective at self-regulating process of learning.

To answer the main research question (See Chapter 1, paragraph 1.4) literature shows that children learn in groups. In actual fact, children learn collaboratively and cooperatively. To be clearer Alessi and Trollip (2001:34) define collaborative learning as environments in which learners work on a shared goal or project. Collaborative and cooperative approaches are new methods of learning based on a fundamental shift away from a teacher-centred approach to a learner-centred approach.
It is from this discussion that the Digital Doorway project is seen as a wagon to the new methods of learning, as it encourages a learner-centred approach, where children are actively involved in the learning process and work collaboratively. This approach of learner-centredness is emphasised by South Africa's current education approach

"Outcomes-Based Education (OBE)". The Department of Education (2003:13) identified Information and Communication Technology as one of the most powerful tools to support learners to achieve the national critical outcomes as it encourages:

- a learner-centred approach;
- active, inquiry-based and hands-on learning;
- collaboration amongst learners and facilitators; and
- critical thinking, creativity, informed decision-making and analytical skills.

The Digital Doorway functions in cooperative and collaborative learning. The idea of cooperative and collaborative learning supports the concept of Minimally Invasive Education (MIE) where children learn by working it out for themselves, and from their peers. There is also incidental learning (discovery) because when the "know how's" are absent, children have to learn from their mistakes. One can conclude that the Digital Doorway accommodates teaching from both perspectives.

The following are number of benefits that the Digital Doorway has:

- There is no specific security, but the place is observed to be safe. The machines were designed to be robust and vandal proof and the components are water proof even in adverse weather.
- The learning station is set up in an outdoor setting, which children can access at any time. The setting is appealing to children and conducive to supporting learning by exploring in a non-threatening environment.
- Free and unlimited access offers all children (in-school and out-of-school) opportunity to utilise the station, the opportunity for users to interact with technology on their own terms and there are also the results of improved computer awareness and literacy.
- The project emphasises voluntary participation in a mix of recreational and educational activities, and a large proportion of the program's activities include the typical uses of computers, such as educational software, computer games, and Internet searches and communication.
- For the children, the programs with sound and visuals appeal are the most popular. For an example, content includes: Science software, Geography,

> Mathematics, Puzzles, encyclopaedias, Office Suite, music programs, educational games, agricultural information and Story maker (http://www.digitaldoorway.co.za).

Due to the positive issues that children mentioned about the Mamelodi Digital Doorway installation, the researcher found that significant learning takes place amongst children, for example, there is an improved computer awareness and literacy, the opportunity for users to interact with technology on their own terms, promotion of computer literacy without external resources such as computer science teachers, and transfer of learning to the community. Most children came to the Digital Doorway without basic computer skills and knowledge, but obtained computer skills by learning from their peers and also learning by themselves.

To support the above statement, respondents mentioned that the object is called an “Eskom computer”, and some say that it is an “Internet”. This clearly shows that they have little experience of what is going on in the kiosk. The respondent that mentioned that the object is an Eskom computer did so because the word 'Eskom' is visible on the top part of the computer, so it is possible that one can say it is the real name or brand for the object. According to literature, the brand is put there because the Mamelodi Digital Doorway project is a joint venture between the CSIR, DST and the power utility Eskom.

It was also discovered that some children lack knowledge of computer terminology because when asked which websites they use, one indicated that he visited 'www.something'. In essence the website of this nature does not exist. One of the reasons for mentioning this wrong website might be that the respondent heard someone talking about the World Wide Web and just memorised as these children learn from others. Although some of the children were aware of how the computer basically functions, their computer skills and knowledge have now increased.

Today, children and teens frequently use the computer and the Internet for their schoolwork and to obtain information. The social effects of children’s computer use vary widely, depending on the amount of time spent, type of activity engaged in and the nature of content or information delivered. From the results above, it can be seen that

children and adolescents are spending increasing amounts of time using the computer to play multi-user games and to communicate with others through the Internet.

This notion is also supported by Papert (1993: ix) when saying 'across the world children have entered a passionate and enduring love affair with the computer'. The love affair that Papert (1993: IV) refers to, involves more than the desire to do things with computers. This love affair also has an element of possessiveness and, most importantly, of assertion of intellectual identity. Large numbers of children see the computer as “theirs” -as something that belongs to them, to their generation. Many have observed that they are more comfortable with the machines than their parents and teachers are. They learn to use them more easily and naturally.

The results indicate that although people used the Digital Doorway to become computer literate, they did not use it to do productive work. The study also indicated that boys are more frequent users of computers than girls, mostly because of their interest in playing computer games. Studies indicate that children who play such games can improve their visual intelligence skills – skills that may provide them with 'training wheels' for computer literacy. Such skills may be especially useful in the field of science and technology (http://www.effectsoncognitive.htm).

In conclusion, the researcher found the Digital Doorway project to be of enormous importance to South African citizens as a whole, because it is not meant for one group of people; all respondents liked having the Digital Doorway in their area (Mamelodi). This is supported by reasons given by respondents. Respondents had the most fun with their friends at the learning station, and also preferred to learn new things. Tapscott (1998:7) supports this view by explaining that children are learning, developing, and thriving in the digital world. They need better tools, better access, more services and more freedom to explore.

The learning experiences from the project are that the DST and the CSIR aimed to introduce computer literacy into the ambit and experience of all South Africans through the implementation of the concept of Minimally Invasive Education. The aim is to provide people in rural and disadvantaged areas with freely accessible computer equipment and open source software, enabling them to experiment and learn without formal training and

with minimal external input. The findings of this project could serve to inform policy makers to introduce alternative mechanisms for computer literacy. It could also suggest another pathway towards building human capacity in support of the advancement of the Information Society in South Africa and its adjacent regions.

4.6 Conclusion

In this chapter the categories, which were identified during the data analysis and coding process, were discussed. Discussion was based on the quotations obtained from the transcripts of individuals and focus group interviews (See appendix B and C). Literature applicable to the clusters of the category was also discussed in an effort to compare the views of respondents.

The research findings show that the effective implementation of MIE is the main requirement for the improvement in the acquisition of computer literacy skills in the Digital Doorway. This system of education is very useful in the area of learning by doing. Children show a keen interest in the usage of a computer, as it is free and accessible at any time. The next chapter, Chapter 5, presents the recommendations and conclusion of the study.

Learning results in the establishment of internal states that influence the individual's choices of personal action, which is called attitude. Attitudes do not determine particular actions; rather, they make certain classes of individual action more or less probable. For this reason, attitudes have often been described as 'response, tendencies' or as states characterized by 'readiness to respond' (Gagne 1985:219).

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The study was conducted by observing the videotapes, conducting individual semi-structured and focus group interviews. This chapter presents the main findings of the observations of the videotapes, individual semi-structured interviews and the focus group interviews. The chapter furthermore presents conclusions drawn from the study and a number of recommendations for further investigation.

5.2 The main findings of the study

The main findings of this study are discussed with regard to the results obtained from the video-taped observations, individual semi-structured interviews and the focus group interviews.

5.2.1 Main findings of the video-taped observations

The study was conducted by observing the videos in MPEG format on a computer. Because sound could not be distinguished, the video could not play any sound part in the recordings. The computer in the kiosk was video-taped by the CSIR for twenty-four hours a day. This started immediately after the kiosk had been erected. Each video usually covers a period of one hour stored in a name consisting of the date as well as the time of the recording. This study covers the period from 2003-12-06 to 2003-12-19. The detailed description of all the observations is available in Chapter 4.

According to Grobler (2003:17) observational studies allow the researcher to see first-hand what is happening rather than depending on respondents. When a researcher observes, data is organised in the brain to make sense of it.

Observations of videotapes were used to address the following main research questions:

5.2.1.1 To what extent had children acquired computer literacy skills through the launching of the Digital Doorway project in Mamelodi?

To obtain the answers to this question, observations indicated that children visited the kiosk in groups ranging from four to ten. These groups normally consisted of the “know how” children and the “know not” children. The “know how” children always take a lead in playing with the computer whereas the “know not” children are mostly passive.

The Digital Doorway kiosk at Mamelodi was frequently used. This is indicated by the statement that the computer was used before 10H00 in the morning and after 17H00 in the afternoon (See Chapter 4, paragraph 4.2.1.1). Children were the most popular users of the kiosk.

Children, especially small boys, were the most common participants. They normally frequented the kiosk in groups. It was seldom that an individual child visited the kiosk. The reason for this is that some would learn from others.

The time spent on the computer differs according to the type of activity done. Some of the groups stayed longer while others stayed shorter. This was determined by interest, for examples, the games kept children a long time in the kiosk. They could spend almost one to two hours playing on the computer.

5.2.1.2 How did these children acquire computer literacy skills without the guidance of a facilitator?

To answer this question, observations show that children learned incidentally and cooperatively to acquire computer literacy skills. It has been discussed that children frequented the kiosk in groups consisting of the “know how” children and the “know not” children. The “know how” children are normally the ones with computer knowledge and skills whereas the “know not” children are the ones without computer skills and knowledge. It was discovered from the observations that the “know hows” always help and teach the “know nots. Even if some of the children did not know how to operate the computer, they kept on pressing the buttons, trying something on a computer.

5.2.1.3 What is the nature of the social interaction between children?

The observation proved that there is mutual interaction between children who use the Mamelodi Digital Doorway project. Even if a fight was observed, children still worked together in groups where social interaction takes place all the times. This social learning is clarified by code SI 10 (See Chapter 4, paragraph 4.2.1.5).

5.2.2 The main findings collected during the individual interviews

The research findings show that the effective implementation of Minimally Invasive Education (See definition in Chapter 1, paragraph 1.2) is the main requirement for the improvement in the acquisition of computer literacy skills at the Mamelodi Digital Doorway project. This strategy is very useful in the area of learning by doing. The findings of the individual interview were discussed under the main research questions:

5.2.2.1 To what extent had children acquired computer literacy skills through the launching of the Digital Doorway project in Mamelodi?

From the individual semi-structured interviews, the findings show that respondents acquired basic computer knowledge and skills. This was evident from the fact that they could use the word processor to type letters and assignments. Respondents could also browse the Net to look for information; they could click, start and open a program, delete and close a program.

During the individual interviews it was also found that some of the children are computer literate and are able to use the computer. This is possible because they mentioned that they learned to use the computer at school and at home. Apart from the ability to read text, literacy also involves image and screen literacy, particularly information navigation (http://www.tectonic.co.za/view.php? id=859).

From these findings it is clear that children can develop computer skills. According to the American Heritage Dictionary of the English Language (2004) a skill is an art, trade, or technique, particularly one requiring the use of the hands or body.

A more important finding was the fact that children use the computer for various activities, such as education and entertainment. These activities reflect that children are always engaged in learning.

5.2.2.2 How did these children acquire computer literacy skills without the guidance of a facilitator?

From the individual semi-structured interviews it was found that some of the respondents are computer literate as they mentioned that they studied the computer at school. Those that were not computer literate learned from the one who was computer literate. Learning is done through observation, imitation and self-study. Children sometimes memorise the entire procedures for doing something, for example how to open a program and retrieve a saved picture.

5.2.2.3 What is the computer jargon acquired and which computer applications are used?

The findings from the individual semi-structured interviews show that children have knowledge of computer terminology. The term ‘knowledge’ as explained in Chapter 4 is used for the confident understanding of a subject, potentially with the ability to use it for a specific purpose (http://en.wikipedia.org/wiki/knowledg). Children were able to mention several computer terms like, Internet, keyboard, mouse, screen, monitor, speakers and printer.

Children could also mention the computer applications they use, for example the Internet, educational sites, music and game applications. Microsoft and Internet Explorer were the most common used applications.

Although children were able to use the computer, not all of them could use the Internet and some lacked knowledge of the World Wide Web. This was indicated by one of the respondents when reporting that he normally visits www.something. In essence, there is no such website, if you click it, there will be no results. The World Wide Web is an on-line service allowing users to access information from various Internet sites. It is a simple

hypertext format that let users move from site to site by clicking on-screen buttons or typing a simple command.

5.2.3 The main findings of the focus group interviews

From the focus group it was discovered that all children liked the computer because to them it is a place of having fun and meeting with their peers. Children found the computer to be easy to operate because they learned from their peers who possessed computer skills. It was evident that the Digital Doorway project is an instrument of Minimally Invasive Education, because children, who did not have the means of mastering computer skills, learnt with or without minimal help from the outside.

Cooperative learning took place most of the time, because some of the children had had experience with the computer. “The human species seems to have cooperation: we desire and seek out opportunities to operate jointly with others to achieve mutual goals” (Johnson & Johnson 1991:6). Cooperation is an inescapable part of human nature and human life. It is difficult to think of many human activities in which the ability to cooperate with others is not important. Cooperation is the heart of family life, economic systems, legal systems, and the worldwide community of humans.

Children who were not sure of their computer skills would watch all the time. When the group split up and left, such a child would try to press the keys on the computer. Sometimes the child would leave and return when the kiosk was empty. The ‘know how’ always led and showed others what to do. This was done through peer teaching where they observed, imitated and or practised the skills. Also, learning took place through the biblical mode of sharing.

Although there were some malpractices and problems with the Mamelodi Digital Doorway project, children indicated a positive attitude to the computer and made suggestions for improvement. Children showed a keen interest in the usage of computers as the project was cost free and there was no license agreement between the service provider and the user. Furthermore, the outdoor setting encouraged a sharing philosophy where there were 24-hours of access to technology and content.

5.3 Recommendations and implications

Although the results show that the majority of users at Mamelodi Digital Doorway are computer literate and have access to the computers either at school or at home, it was vital for the CSIR to put a computer in Mamelodi to bridge the technological gap that exist between the community.

Based on the under-mentioned ideas the researcher would recommend that the CSIR continue to establish Digital Doorway projects in South Africa because the vast majority of South Africans living in the developing areas of South Africa do not have access to computers and are therefore computer illiterate. It is important that plans are made to overcome this problem. This was also indicated by the Green paper published by the Minister of Welfare and Population Development in 1995 which states that the vast majority of South Africans (51, 7%) live in developing areas and that only half of the rural population is literate. Most South African households are poor and the distribution of wealth and income is reckoned as of the most unequal in the world. Most people still do not have sufficient access to education, electricity, water and health care (May 1998).

The Department of Education (2003:1) asserts that in South Africa there is still a huge digital divide (the gap that exists between those who have access to and use technology and those who do not have access to or use technology), although the use of Information and Communication Technologies increased by 20% in 2002. At this stage only 6.4% of South Africans use and have access to the Internet, compared to 72% Americans.

The New Partnership for Africa's Development (NEPAD) identified Information and Communications Technology as an effective tool to reduce poverty in Africa. South Africa's president, Mr. Thabo Mbeki, also stressed the importance of Information and Communications Technology as critical in the fight against poverty in the following way:

> *We must continue to fight for liberation against poverty. Against under-development, against marginalisation and…information and communication technology…is a critically important tool in that struggle* (Department of Education 2003:3).

The Department of Education (2003:3) has identified the following three critical elements that will determine or even hamper Information and Communication Technology's future as an effective tool for economic as well as social development:

- Cost: – solutions have to be cost-effective to be able to reach the most remote parts of South Africa.
- Sustainability: – technology has to be sustained to be effective.
- Utilisation: – Information and Communication Technologies have to be efficient to be effective.

It is from the above notions that the Digital Doorway project launched by the CSIR might prove a cost-effective computer training solution for the majority of people living in the developing areas of South Africa.

From the observations of the progress made by users, it is obvious that the project is contributing to an increased awareness of and interest in computers.

5.4 Limitations of the investigation

During the fieldwork of this research project, the researcher soon discovered that she would not be able to answer all the critical questions set, as the data that emerged from the interviews indicated that there were numerous problems which inhibited children from working on the computer and improving their computer skills at the Mamelodi Digital Doorway project.

During the various interviews conducted with the children, it became evident that the Digital Doorway was not functioning as expected. Children indicated that most of the time the computer jammed therefore they could access it. On investigation the researcher found that this was quite true because during this time of the interviews the computer was out of order.

Children reported that there was no one to report the matter to as there was no overseer responsible for the maintenance of the computer equipment at the Mamelodi Digital Doorway learning station and the CSIR was also unaware of the fact that the computer

was not working. This was found true as the researcher had to inform the CSIR about the condition of the Mamelodi Digital Doorway project.

As the computer was out of order, children could not arrive at the set time and the expected number; few groups just came to check if the computer was working and then left again.

5.5 Recommendations for further studies

From this research conducted in the Mamelodi Digital Doorway project it became apparent that more research on this project is needed. Categories that warrant further research are:

- Are children really benefiting from their use of the Digital Doorway?
- Can the Digital Doorway truly improve the process of learning or is it dumping children and misrouting our educational efforts?
- Is it possible for children to spend time in the kiosk, and what are they really doing? Are they not addicted to the Net?
- Children spend most of their times playing games; are these games not leading them to a violent generation?
- Is this technology not stressing children out?
- Why do males mostly frequent the Digital Doorway?
- To what extent do children interact with their peers in the absence of an adult?

If these categories can be properly addressed, the Digital Doorway projects will dramatically improve the learning process whereby children learn to cooperate, work in teams, solve problems and take responsibility for their own learning.

The researcher believes that the Mamelodi Digital Doorway project is proving to be an important catalyst in the introduction of open source learning in South African environment.

5.6 Conclusion

The CSIR, the DST and power utility Eskom launched the Digital Doorway project in Mamelodi to evaluate the feasibility of an alternative computer training approach following a Minimally Invasive Education approach. Within the scope of the CSIR, this research study tries to explore how children acquire computer literacy skills without the guidance of a facilitator.

This chapter concludes an investigation into how a computer is used at the Mamelodi Digital Doorway project, in Eastern Pretoria, South Africa. Firstly this dissertation looked at Minimally Invasive Education and its influence in South Africa.

The purpose, design and methodology of the research methodology were discussed. Data obtained from interviews were used to support data from observations captured from the screen shots.

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APPENDIX A

Detailed description of observation of the video material for Mamelodi Digital Doorway project taken for two weeks (From 2003–12–06 to 2003–12–19) at the CSIR.

Week 1: 2003-12-06 – 2003-12-12

The computer was still new and people did not know what to do with it. People popped in all the time and looked at it. They looked behind it, around it, and then touched it. It was seldom left alone without people visiting or around it. The computer was used before 10H00 in the morning and after 17HOO in the afternoon. Adults who passed by entered the room and pressed some keys. Teenagers and children discovered it later on, and children were observed helping an adult.

Day 1

Two adult women and a male visited the computer room. The man stood in front of the computer while the women kept a distance away. Women left after few minutes. Two men arrived shortly after the women's departure, looked at the computer and they also left the room shortly.

Later a group consisting of three children and one adult arrived; the security guard entered with them and started pressing the computer keys. Children were onlookers or spectators not knowing if they might touch or not.

After some hours, four adult males came in, the one immediately started to press the buttons, it seemed as if he knew what he was doing, and the other three became spectators. One of them was watched while the other two were a bit distant.
The security guard also came to watch. After a while the active adult and one of the spectators left, leaving the one who was closely watching and the other spectator. The closely watching spectator became active on the computer with the other distant spectator interested and closely watching.

Day 2

The room stayed empty until a teenager visited it and started to press some buttons. He got a picture on the computer. An adult and a teenager later joined him and looked on. No children visited the room on this day.

Day 3

The women visited the kiosk with the security guard showing them something.

Day 4

Visits to the room increased enormously. A boy was in front of the computer for a long time, but other children came in. Some women also used the computer on this day.

Day 5

There was no one in the morning and the computer was left alone. Only later during the day a group of teenagers and one child visited the computer room. It showed that one of the teenagers knew how to use a computer. He started to play games on the computer while the others watched. The group stayed for approximately two or more hours in the computer room. More teenagers and children increased in the kiosk all the time. They talked but seemed uninterested in the computer.

Day 6

The teenagers mostly did this day's activities. They would look, try something and go away. As the day went on, more teenagers frequented the room. Amongst them there was usually one who knew what to do. He would press buttons while others watched and became spectators or onlookers.

Children also visited the room; they looked at the computer and went away. The security guards were also seen during this day.

Week 2: 2003-12-13 – 2003-12-19

This week more children discovered the computer and they frequented the room to use the computer. They came in groups of about 5-8. Amongst them there were those who knew how to use the computer. As a matter of fact, these “know hows” became the leaders because they taught others how to use the computer. Those who did not know the computer became spectators or onlookers, because they observed and learned from the” know hows”. They were therefore referred to as the “know nots”. Cooperative learning and Minimally Invasive Education took place most of the time because some of these children mastered the computer skills observed by practising on their own while there was no one in the room.

There was a mixture of age groups, teenagers, adults and children. In this situation, teenagers mostly took the lead and children became spectators. Sometimes children became bored, and started playing outside until the teenager and or adults left the computer room. Children also had an opportunity of teaching teenagers some skills on the computer.

Day 1

On this day a young woman visited the room and started doing something on the computer. There was no one in the room and it seemed that she knew what she was doing. Later, another woman joined her and they worked together on the computer.

Day 2

Early in the morning, three children (boys) visited the room. Two of them started fighting while the third tried to stop them. They left after some minutes.

After they had left another child (boy) arrived and stood on the footstool, as he was too small to reach the screen. This child did not touch any of the buttons.

After a while, five young children (boys) visited the room with a security guard and showed them a few things as they stood together around the computer. While still there, two other children joined them. One of the children who was in front of the computer got something to work on and they became excited. This showed they were inside some games.

Day 3

Young adults visited the kiosk in the morning. One of them used the computer while the others watched.

During the day, a child and a teenager (both boys) visited the room. The teenager pressed the buttons while the child looked on. They looked happy and interested.

Day 4

The visits to the computer room increased. Adults who were on their way to work looked in shortly and passed by.

During the day, three teenage boys visited the kiosk; one started pressing buttons while the other two watched. A bit later, two other teenage boys joined them. They were very interested in the computer and its use. They stayed in the room for a considerable time.

Day 5

A boy and a girl visited the computer room. The boy played games while the girl looked on interestedly. The boy helped the girl to do something on the computer. They then left the room.

The teenage boys who were seen the previous day visited the room. Two adult women who became spectators joined them. When the teenagers left the room, one of the women started using the computer.

Day 6

The visits started to increase in large numbers. A teenage boy was working on the computer while some of the children (boys) were watching. Later on, the group left and a child about the age of eight, alone in the computer room, stood on the footstool, looked around and behind the computer. He tried to do something on the computer. This boy was unsure of himself but kept on trying to do something. He then discovered a game. He left the computer room after few minutes when three adult men drinking beer visited the kiosk. These adults were not interested in the computer.

The same child (let's call him child X) later came back with three adults. One of these adults worked on the computer while the others were spectators. The child also became the spectator. After a few minutes the adults left the room and another child (let's call him child Y) joined the first child who was in the kiosk. At this time child X was active on the computer, and child Y watched with interest and learned while looking. After a while child Y stood with child X on the footstool.

While these children were still busy, a teenage boy entered the kiosk, but only watched from a distance. Spectators left the room while child X stayed in and continued playing on the computer. People came in, looked at what child X was doing and left.

Another teenage boy came in and watched what child X was doing. They discussed a while. After some time, the teenage boy started to press the buttons.

Another group consisting of three children (boys) and one young adult (male) visited the kiosk. These children flocked together in front of the computer. One of them took the lead in front of the computer as others pushed to get their view in front of the computer. Children also pressed the buttons. The adult kept on watching them.

Later they were a group of eight in front of the computer. After a while the on-looking teenager took over with other children taking turns in front of the computer. The group stayed longer and seemed to shout excitedly.

Later on, one of the children took over; it was the first time that he was seen in front of the computer. It seemed as if he had clearly seen and learned enough by watching. The previous user (child X) had to help at times**.** Other children also tried to use the computer with the previous user telling them what to do. They took turns in a friendly manner.

APPENDIX B

TRANSCRIPT OF INDIVIDUAL INTERVIEW

Keys: Interviewer = Q; Interviewee = R

Q: What do you call this object and what do you know about it?
R: This is called a computer. I use it to type and browse the web when I look for sales in different shops.
Q: It sounds interesting. How do you look for shops' sales?
R: I browse the Internet and get straight to the web where sales are displayed, then compare the prices of the shops and what they sell.
Q: Tell me something. Are you computer literate?
R: Yes. I studied computers at school.
Q: Is this computer the same as the one you use at school?
R: No. The computers at my school are divided into three parts; there is a keyboard, a mouse and a monitor. This one does not use a mouse and a monitor. At school again, we can't use the Internet. Here we use the Internet
Q: Tell me about the programs you use and why you use them.
R: I normally use the Internet for sales and education programs for career guidance.
Q: I see only one computer here; do you get enough chance to work on it?
R: Yes, sometimes there are no people in the computer room, especially in the morning as children are at school. When people are in the room using the computer we wait until they finish their work, then you can use it freely.

Respondent 2

Q: Can you tell me something about this box?
R: It is a computer. You can complete your school project here.
Q: How do you complete your project here?
R: You simply press the touch pad and click the program you want on the screen, and then you'll see the messages coming out. So you know if they are for good for you and learn them.
Q: Where did you learn to operate the computer?
R: At school.
Q: Is this computer the same as the one at your school?
R: No. If you type something here you cannot save and print it out. At school you can save your information on my document and find it later when you look for it.
Q: You say you cannot print, then how do you carry this information that you get here?
R: If the information is not much, I usually write the notes down. But if it is more, I go to the Internet café and print it out.
Q: which programs do you use, and tell me why?
R: I always use the Internet to look for educational information to complete my science projects.

Respondent 3

Q: How often do you visit this place?
R: m… I can say two times per week, sometimes three times per week.
Q: What forces you to come here?

R: I come to play games on the computer with my friends.
Q: Are there games on this computer?
R: Yes.
Q: How do you find them?
R: One of my friends knows the computer, he always presses the buttons and games come out.
Q: When your friend presses the button what are you doing?
R: I look at him and sometimes I also press with him.
Q: Have you ever pressed the buttons alone?
R: No, I'm always with friends.

Respondent 4

Q: Can you tell me anything you know about this box?
R: It is an Escom computer. Escom put it here for us to play games.
Q: Do you know how to play games on it?
R: I don't know.
Q: Why do you say you play games whereas you don't know how to use it?
R: Eich! My friend is the one who knows it. I come with him and watch how he plays the computer.
Q: Have you tried to play games?
R: Yes.
Q: How did you find it?
R: Difficult as there was no one I could ask to help me.
Q: Are there no fights, as many people want to use the computer?
R: No, we give one another a chance. Sometimes older people want to use it, we go outside and let them use it. When they are finished we come back to play our games.

Respondent 5

Q: What do call this box?
R: It is a computer eh… I can still say it is an Internet because when you type a web address you get straight to it and get the information that you are looking for.
Q: Which web address do you normally use?
R: I once visited www.gov.co.za looking for a budget speech.
Q: Interesting. What were you doing with the budget speech?
R: It was part of my assignment.
Q: This shows me you know something about the computer?
R: Yes, it's true. I learned computer as part of my studies at school.
R: Which other programs do you use?
Q: I visit educational sites for my studies and sometimes I listen to music.
Q: I heard that most of you come in groups. How is it possible for you to get chance?
R: We know one another as we come from the same section, and then it makes it easy for us that we can share the computer. Sometimes we work together, because some do not know how to use the computer, therefore we help them.

Respondent 6

Q: I saw you using this object; can you tell me something about it?
R: I can say it is an Internet, because when you look for something like the games, you type www.something, and then message will appear on the screen. If it is not what you want, you click cancel and start again.
Q: Where did you learn to use the Internet?
R: I saw other people using the Internet, I practised it myself then, it's how I leaned.
Q: Why do you use this Internet?
R: I play game "dragon ball zee" and music.
Q: There are many people that use this Internet, how do you get your chance?
R: If you arrive here and find people busy, you wait for them to complete their work. If we are only children we play together if someone found a game or music. Normally when we are playing and our brothers arrive we go outside until they are gone, then we continue with our play.

Respondent 7

Q: Have you used this object before?
R: Yes, I used it for several times.
Q: Please tell me how you use it.
R: I touch the touch pad and click to the program that I want. Information will pop out on the screen then you decide whether you read it or not if you don't want it you close it and open another one.
Q: What is you favourite program?
R: Games.
Q: Where did you learn to operate this computer?
R: I saw on the newspaper written www.something. While I was here with my friends playing the computer, I saw them writing the same words that I saw on the newspaper, and then pictures popped up. I looked at how they do it for several times, then one day while I was alone I practised what I saw then I also started to play the computer.

Respondent 8

Q: Can you use the computer?
R: Yes, I can.
Q: Where did you learn to use it?
R: At home.
Q: Hm! Do you have a computer at home?
R: Yes, it is my aunt's, but it is not the same as this one.
Q: How does it differ to your aunt's?
R: My aunts' computer has a box where she puts CD inside, there are also some speakers that we listen to music and she can also print pictures for us.
Q: You said you learned the computer at home. How did you learn using it?
R: Everyday when my aunt works on it, I look at how she uses it. I always practise to operate it.
Q: Which programs do you like the most?
R: I play games and listen to music.
Q: What is it like to work in groups on one computer?

R: Interesting, because if you don't know something you ask others and they will show you how to find it.
Q: Are there no fights between groups?
R: No, we respect one another by sharing the computer. When the other group is using the computer, we play outside and when they are done we then play it. Also when the adults arrive we give them a chance to do their work, we may go forever or come back lately.

APPENDIX C

TRANSCRIPT OF FOCUS GROUP INTERVIEW

Keys: Interviewer = Q; Interviewee = R

Q: Tell me about this computer, do you like it? What is it that you like?

R1: I like it because it is important to us all; everyone uses it that is, eh… old people and us children.
R2: I like it; it helps us with our schoolwork. Everyday when you come here there are school children doing something.
R3: I can say I like it because we play games here always.
R4: I like it because it keeps us from the street; instead of doing funny things like using drugs we come here and play games and music.
R5: I like it because you can use it at any time. It does not close, it is ready all the times and we do not pay like at other computer cafe, so we use it freely.

Q: I heard everyone is happy about the computer. How did you find it? Was it difficult or easy to use? Tell me more about your experience.

R1: It was difficult for me to play at first. I came here and looked how other people play it, and then I practised. Now I can play games, music, and look for other things on the computer.

R2: It was difficult for me. The first time I saw it I did not know how it is used. I kept on looking what other children were doing and I saw the games. I looked how they got these games and when there is no one here I practise what I saw other people doing.

R3: It was easy because my friends know how to play it. I always come with them here, they play and I look at how they do it. Sometimes they give one a chance to play.

R4: It is difficult because there is no one to ask how to play it. Most of the time I come here I have to wait for other people to arrive so that they help me to play it.

R5: It was easier for me, because I learned about computers at school. I looked at it and pressed the buttons, then music popped out, therefore, games followed then we started playing games. The problem was that it is not the same as the ones we use at school so you have to struggle first before you can get it right.

Q: Why do you always use this computer?

R1: I play games.
R2: To play games.
R4: I use it to find information for completing my home works and assignments.

R5: I use it for several things like…I complete my studies, read news and stars, play music and games.

Q: Which programs interest you?

R1: I like game programs.
R2: I also like games.
R3: Games and music.
R4: Education programs especially the Science one.
R5: I use the Internet, Word, games and music programs.

Q: What is your wish about this computer?

R1: I wish there is someone who takes care of it because anyone uses it the way he likes and some of the children use it to look for funny things like pornography.

R2: I wish the room can be enlarged and more computers be brought in for us to get enough time and space to play.

R3: I wish there is caretaker, because most of the time the computer is out of order. There are some of the people who overload it with information without giving it chance to reboot. As it still tries to open the sites, they hit it, and then the computer jams.

R4: My wish is to see the computer inside the yard where there is security and restrictions. You see the room is outside the yard; there is no door and anyone those who have knowledge those who do not know what they are looking for just come in and try to use it. Then the computer is out of order. The other thing is that during the night some of the people use it as their toilet, and then when you come the following day you cannot use it as it is unhealthy to work in such conditions.

R5: I wish the government employs someone to look after the computer, help us when we need information, lock and open it.

Q: What do you think may be the cause for people to destroy the computer?

R1: I think these are the type of people who are not educated and they do not know the use of this computer.

R4: I also think that they are people who did not attend school and they don't know how to read. If they knew how to read, they could read the information on the screen and follow what the computer requires.

R5: These are people who don't know what they want. Most of the times they just click buttons and many programs appear that the computer finds it difficult to open; as such it will be out of order until it is fixed.

Q: How can we help people to see the importance of this computer and use it correctly?

R1: There must be someone who takes care of this computer and helps people who don't know how to use it. The computer people must block all the sites that are not good for children.

R2: The government must train people on how to use the computer.

R3: The computer room must be placed inside the yard because there is security at the gate that will ask you questions. The other thing is that it has to be locked and someone must look after it. More computers must be brought in to avoid traffic and overcrowding on the computer.

R4: There must be security like in other computer centers, where entry cards are provided, and then when you enter you produce your card. If you don't have a card you will be denied entry.

R5: I think the room must be locked during the night to avoid drinkers and other unwanted people to use the computer.