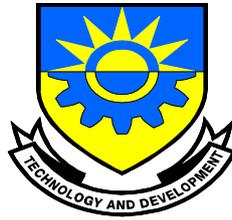# POLYTECHNIC OF NAMIBIA

SCHOOL OF INFORMATION TECHNOLOGY

DEPARTMENT OF SOFTWARE ENGINEERING

TITLE:

Development of a Computer-Assisted School Information System for Namibian Schools

Thesis presented in partial fulfilment of the requirements for the degree of Master of Information Technology at the Polytechnic of Namibia

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March 2012

Declaration

I, **Jacobina Mwadhinandje Nampila**, hereby declare that the work contained in the mini–thesis, entitle "**Development of a Computer-Assisted School Information System for Namibian Schools"**, is my own original work and that I have not previously in its entirety or in part submitted it at any University or other higher education institution for the award of a degree.

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Abstract

Information Technology (IT) is taking on greater significance and importance for bringing a lot of benefits to educational institutions such as schools. The benefits IT brings include enhancing productivity, improving efficiency, providing better service and knowledge sharing, increasing competitiveness, reducing costs, just to name a few. This has also led to a rapid development of school information systems.

The aim of this research work was to analyse schools administration procedures and construct a computer assisted system for administering Namibian government primary and secondary schools in admission procedures, storing of officials documents, learners and teachers records, attendance registry, storing learners examination grades and generate reports.

The population of the research survey was the government primary and secondary school employees whereby teachers, secretaries and principals were interviewed. A judgmental sampling was used to select the schools whereby the following criteria were used; schools that follow government procedures, schools with computers being used fulltime, school with a pass rate of 35% of grade 10 or grade 12 (for secondary school).The sample included three from Khomas region, one from Otjikoto region (North), two from Omusati region (North). The questionnaire, face to face interview, a focus group and the study of the Education EMIS questionnaire were used as data collection method for the research. The findings show that affordability of software and   computers maintenance is possible from the school funds. One conclusion from the interview is that in one school out of six some schools there were low or poor acceptance and efficiency of the school administration software they have purchased so they keep on switching between different software. A Dynamic System Development method was selected and used in the design and implementation of the software system, because of its rapid delivery of systems.

Therefore, the constructed system might solve some of the gaps exhibited while using current School administration software, by providing features that are needed by the schools. However due to time constraint the implementation of the system did not allow a full usability test of the proposed solution.

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Acronyms

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CAS   –   Continuous Assessment

CIS   -   Computerisation Information System

DSDM –   Dynamic System Development Method

EMIS   –   Education Management Information System

GeSCI   -   Global eSchools and Communities Initiative

GIS   –   Geographical Information System

HIGCSE-   Higher International General Certificate of Secondary Education

HoD   -   Head of Department

IGCSE   -   International General Certificate of Secondary Education

ITEM   -   Information Technology Education Management

LAN   -   Local Area Network

MUSAC-   Massey University School Administration by Computer

NETSS   -   National Education Technology Service Support

NGO   -   Non Governmental Organisations

NIED   _   National Institute for Education Development

NSSC   -   Namibia Senior Secondary Certificate

RAD   -   Rapid Application Development

SaaS   -   Software as a Service

SAMS   -   School Administration and Management System

SIMS   -   School Information Management System

VDI   -   Virtual Desktop Infrastructure

Chapter 1

1. Introduction

The introduction chapter gives the background to the research problem and the study, it also introduce the motivation for pursuing this research. The chapter presents the objectives for meeting the goal and the limitations of the study. Finally the overview of the structure of the thesis is outlined.

1.1 Background

Nowadays, Information Technology (IT) is taking on greater significance and importance for bringing a lot of benefits to educational institutions such as schools. The benefits IT brings are such as: enhancing productivity, improving efficiency, providing better service and knowledge sharing, increasing competitiveness, reducing costs, etc. "Enhancing the efficiency of your IT Infrastructure" (Clark W.F., n.d.). This has also led to a rapid development of school information systems.

Many countries in the world have schools management information systems implemented that are even linked to the government department of education. Countries like Hong Kong, Australia, New Zealand, have implemented them in the early as 1980's (Visscher, 1995).Data from those schools no longer entered more than once into the system and sophisticated programs can provide information about individual schools and cross schools comparison can be done. The main reason is most of those countries' primary and secondary schools are regarded as being the responsibility of the government and the schools are subjected to some degree of government control. The government designs the education system, the personnel structure and the content of the curriculum.

School Information management system (SIMS) was defined by Telem (1999; p.36) as "a management information system designed to match the structure, management task, instructional process and special needs of the school".

Research in various countries also confirms that school management information system increases organisational and managerial effectiveness. Studies done with American school managers by Hedberg, et al. (1992) stated that efficiency has increased in decision making at schools where school management information systems are used. In his study where Gurr (2000) examined effects of school management information systems on primary school managers in Australia, managers stated that use of school management information systems has introduced them information technologies and the facilities, lessened their workload and made management process more efficient, helped them use time more efficiently, made teachers feel themselves more important, made them and the teachers wish to improve themselves more, made important changes in education and teaching, and increased the quality of in-school communication.

Namibia like other countries acknowledges Information Technology's potential in accelerating education management reform. The Namibian Ministry of Education and Culture has developed a Database System called "The Namibian Education Management Information System (EMIS)" since the early 1990. The EMIS keeps the statistics of all schools information in Namibia. It is currently responding to queries from the members of Parliament, ministries staffs, consultants, private sectors, etc. The central Bureau for statistics is also obtaining its entire school statistic from the EMIS. The EMIS works at the Ministerial administration level (Voigts, 1999).

The Ministry of Education and Culture of Namibia has also developed an ICT Policy in Education in 1995, which was updated in the year 2000. The policy has developed a consistent forum to work together and engage all public, private and civil society partners. Because of this partnership most government schools in Namibia have at least a computer (Ilukena, Malone (2006). The partners have donated computers to most government schools and provide them with access to internet (Shafika, 2007). Many teachers, principals, and secretaries have also been and are still being provided with computer trainings by many private and non-governmental organizations (NGOs) such as NIED, Schoolnet, NETSS, Tech/!Na,etc.

The questions are: Are these computers in Namibian schools being also used in management and administrative of schools? Our first observation working with NGOs

assisting such schools is that administration of government schools in Namibia is done manually and school records are kept on papers. Why is it so? Namibia education system and government schools are also centrally managed and controlled by the government like the countries mentioned above. It is this way that Namibia should go, by implementing an information management system for government schools, so that it can achieve the Vision 2030 policy (TechNa!.com, n.d.), which is aiming at providing access to good quality education as at the level of other counterparts in the developed world.

1.2 Research Problem

One of the reasons why government (primary and secondary) schools in Namibia administer their school manually is because there is no software or School Information Management Systems (SIMS) to manage their administration electronically. Schools cannot afford to buy on-the-shelf software which might not even be suitable for Namibian schools environment.

This research is designed to answer the following questions:

- Is it feasible to automate school administrations specific to Namibian government primary and secondary schools?
- Is it possible to provide Namibian government schools with cheaper, user friendly SIMS that fit to their needs?
- How such system should be build, managed and used during admission procedures, storing of officials and student records, record attendance, record grades in examinations, and reports on students performances?

1.3 Aim of the Study

The aim of this research is to develop a computer-assisted school information system which is unique to Namibian government schools and which will assist schools to reduce workloads in every area of school activities by automating many of the tasks undertaken by teachers, and administrative staffs each day at the school level. The system will also help school administrators to fill in easily the principals' statistical report and the yearly questionnaires for the Ministry of Education's EMIS system.

Another aim of this research is to help to promote the Namibian Ministry of Education its ICT Policy and its initiative of Tech!Na of providing hardware and software to government

schools. TechNa! Is a comprehensive strategy of Information Communication Technology (ICT) across the entire Namibian education sector, which ensure that all educational institution are able to efficiently utilize ICT to meet their overall educational objective, with the support of local expertise and international (TechNa!.com, n.d.).

1.4 Research Limitations

The research only focused on Namibian government schools (primary and secondary schools). The size of the population was very small and this was due to time and money for travelling to other regions. Again because of time limitation the system will not include the Time Tabling, Finance module and the usability testing.

It is expected however that the results will be generalizable to other Namibian rural schools.

1.5 Structure of the Thesis

Chapter one is the introduction to the research project. The chapter highlight the background of the study and the research problem which is automating the school administration processes in Namibian government schools and how the system can assist schools to achieve their objective at the same time contributing to the ICT development in Namibian Education. In addition the aim of the study and the limitation of the study were also presented.

Chapter two presents a review of literature related to school management information system. The literature review includes the following among others issues, history of SIMS, definition of SIMS, benefits of SIMS, SIMS design and development, Namibia case and school system, then the conclusion.

Chapter three discusses the methodology used to collect the data, the reasons why such methods were selected and the methods used in the development of the system.

Chapter four presents the findings and the discussion from the interviews and the questionnaire done.

Chapter five discusses the design of the system database and interface.

Chapter six describes how the system was implemented.

Chapter seven offers an overall review of the work done, the conclusion and recommendation for future research.

Chapter 2

2.   Literature Review

School Information Management System (SIMS) has been around since the 1980's and the knowledge regarding the development and implementation of SIMS has been growing in many developed countries. The purpose of this chapter is to site the literature of the development of SIMS. It looks at the history of computer assisted school information system and its evolution, and then it defines the SIMS, discusses existing design and development of SIMS. The chapter also reviews the situation of Namibian Information Management system and ICT education.

2.1 Introduction

The knowledge regarding the development and implementation of computer assisted information system of school has been growing in many countries since 1980's. Amongst the countries are those focused on systems like in Hong Kong, New Zealand, England and Wales, the Netherlands and Australia covering both primary and secondary school phases and using a variety of research methods.

The School Administration and Management Systems (SAMS) in Hong Kong has been the subject of three studies (Fung et al, 1998; Ip Tsang & Kee, 1997; Fung & Ledesma, 2001) and in the Netherlands, Visscher and Bloemen (2001) carried out research using a multiple case study approach to compare patterns in one school against similar and contrasting cases. The Massey University School Administration by Computer (MUSAC) in New Zealand has researched in three case studies at primary, secondary and combined schools (Nolan & Lambert, 2001) and a survey of acquisition and usage patterns (Nolan & Ayres, 1996). This indicates that developed countries have done a lot on the SIMS development and implementation since long time.

2.2 Historical Development of School Information Management System

The history of School information system can be observed into four growth stages, as defined by Nolan (1977, 1979) of which organization pass through when automating their data processing activities. The four stages are *initiation, expansion, integration, and stabilisation*.

The **initiation** development stage of School Information system happened when teachers created the first amateurish school administration programs for their own schools (tailor-made systems) in the 1960s. Some years later software vendors entered into the market, producing their own software or adapting existing software (developed by teachers) to more professional standard (Visscher, 1996).

The second stage, during the **expansion** stage (1970s and 1980s) a few countries developed applications rapidly, whereby several loose, non-integrated clerical and administrative application were used. The limitation in this stage was lack of integration, because school managers were interested in relationship among data, but applications were developed with the main goals of improving the efficiency of school office activities (Visscher, 1996).

The third stage is the **integration** *stage*. This stage was characterised by management information system and the integration modules. The value of management information system was recognised for the first time by the mid 1980's. The aim for this stage was to produce better school information systems that enable more school efficiency and school effectiveness (Visscher, 1996).

The final stage, the **stabilisation** stage, is the maintenance and refinement of information system such as the adaptation of available system in support of new development within school organisation. This stage takes long to be achieved because of new technological and scientific development, such as Internet and psychometrics which promotes new types of support for administrative and managerial school staffs (Visscher, 1996).

Other researchers have also observed the history of school information system with the same features and some differences. Wild & Walker (2001) described the early development of school administration information systems as "trial and error", due to a lack of knowledge of software design by the teachers, who were designing School administration systems that time.

In early 1900s, Pegler (1992) had described the early progress in introducing computerised administration in school in Australia as an ad-hoc basis, characterised by the acquisition of virtually any hardware that was available with a reliance on the efforts of one or two keen members of the staff and different schools taking different approaches as to what to computerise. Pegler (1992) also categorised the direction undertaken on the limited budgets that schools had at their disposal for computerising school administration, into four paths, which he described are not mutually exclusive.

The first path (Pegler, 1992) was to rely on the commercial general purpose programs that are word processors, list manager (a not so true database program i.e. capable of establishing and maintaining links between files in a database). These programs were used for producing letters, academic reports, maintaining information on students, class list, rolls, marks, stock, predict staffing levels, assist in budgeting, etc. However this was not ideal - the information was available at only one computer or with multiple copies, the same data had to be maintained on different machines and this led to a problem in management of integrity of the data and duplication efforts (Pegler, 1992).

The second path was the development of software specific to the needs of schools by the computer buff(s) of the school. Here the data was not easily transferable from one application to another (or to different machines). This was because the applications written by different individuals were written in different languages on different hardware platforms and suited the circumstance of that school, had different methods of storing data, different meanings to the data they stored, provided different solutions to the same problem or were tied to the expertise of the individual-once the computer buff moved on, the application was not maintained and fell into disuse (Ardill, 1988).

The third approach was to wait and see and not to engage in computerisation of administration at all and thereby take advantage of the lessons learnt by others. This was not satisfactory, because it caused a problem of when the school to jump in, since the process was new and rapidly changing technology, one which presented considerable risk particularly to those that were unfamiliar with it (Pegler, 1992).

The fourth path was the commercially available school administration packages. These packages were specifically orientated to the administration of schools and suited for use on

micro-computers. Programmable databases for microcomputers also came within the reach of schools, and some began to take advantage of them. The improvements in technology (smaller size, greater memory, higher speeds, and larger capacity secondary storage), lower costs, and the introduction of programs specifically aimed at school administration, enabled another avenue to be opened up (Pegler, 1992).

Pegler (1992) continued on saying this brought a need for evaluation, and development, of a total solution by the educational authority on the behalf of the schools in its control. Such an approach promised better leverage of the market and better analysis of requirements for an integrated approach.

Pegler concluded that greater challenges remained, where the challenge of successfully integrating both administrative information system and education activities of the school requires not only a strategic model of how such system could work, but it would also need to account multitude of different approaches.

After the year 2000 not much research was done on the development of School Management Information systems (SIMS), this could be because the development was taken over by the commercial software development companies. The researchers were concentrating on implementation and the use of the SIMS (Visscher, et al, 2003 and Visscher et al 2001).

In Africa, no research was done on the development of SIMS, but the countries started on the use of Information technology in education and school administration at the top level of the Ministerial level. In Botswana, the Computerised Information System (CIS) was implemented at the Ministry of Education to manage the teacher workforce; this system has subsequently been expanded and rolled out into regional education offices and schools using a top-down approach (Bisaso, et al, 2008). The goal of CIS in Botswana was to store information about teachers securely, in a manner that would make it easily accessible and retrievable by those who manage and administer teachers.

In Uganda, implementation of CISs commenced as in many developed countries (Visscher, 1991) with schools taking the initiative and buying in systems to help manage the school in a bottom-up approach (Bisaso & Visscher, 2005). Different CISs were used in the

administration and management of secondary schools in Uganda which were locally (software vendors, school staff) and externally developed for clerical purposes especially managing student's records and school finances (Bisaso, et al, 2008).

Developed countries commenced and evolved the development of SIMS, which have placed the foundation of SIMS development, it uses and its importance. While, some developing countries have started to realise the potential of ITEM offers to the efficient and effective handling of information at both ministerial and school levels. So they have started with the implementation of ITEM, but governments of developing countries should understand that the change processes involved in the implementation of ITEM or CIS are gradual and take time; the implication being that investment in CIS or ITEM use should involve enough time for effective assimilation.

2.3 Definition of SIMS

It is difficult to define what Computer Assisted School Information System is, because of the technology on which it is based is changing continuously.

In abstract terms Visscher (1992) defined School Information management systems as an information system based on one or more computer applications which altogether enable the computer supported storage, manipulation, retrieval and distributions of data to support school management. Visscher's definition implies that the nature of the particular information system is dependent on the number and character of computer applications (e.g. student administration, personnel management, student timetabling, etc) included in the information system.

School Information management system (SIMS) was also defined by Telem (1998, p. 534) as "a management information system designed to match the structure, management task, instructional process and special needs of the school". To expand this definition, contribution of information systems to school can be defined as making school programs more effective, enabling teachers to exchange their experiences in more systematic ways, working in teams and determining the needs of students (Gurr, 2000; Pegler, 1992).

Telem (1996, p.2) also explained the SIMS as involving "managing a school or district's key functional data including, but not limited to, enrolment, student and staff demographics, course enrollments, class schedules, attendance, disciplinary actions, special programs, grades, standardised assessments, and health information.

Barrett (1999, p.4), Director of Technology for Conroe Independent School District in Conroe, Texas, also views a school information system as an integrated system that maintains, supports, and provides inquiry, analysis, and communication tools that organise student accountability data into information to support the educational process.

The U.S. Department of Education (2008) considers student data systems as encompassing "hardware and software that provide many different functions to users, such as storing current and historical data, rapidly organizing and analysing data, and developing presentation formats or reporting interfaces".

Looking at all the definition, above, it is in my views that the effective School Information System encompasses the following key performance indicators:

- Collect student data;
- Increase parental involvement;
- Analyse and measure comprehensive student data;
- Make informed decision based on results of data analysis;
- Identify learning problems;
- Create personalized education plans;
- Diagnose student learning styles.

2.4 Benefit of SIMS

A lot of research has been done on the benefit of School Information Management System to school environment, such as in school planning, decision making, and improvement in performance.

Telem (1996, 1999) has done a series of study on the impact of management information system on schools. In his 1996 study involving observation and in depth interviewing, he noted that implementation of the SIMS brought consistency to addressing decision making areas, there was more interaction among school staff and autonomy was lessened, teachers where both more competitive and interacted and cooperated more on instructional issues and the SIM brought a business orientation to school affairs. Visscher (1996) also believes that SMIS can provide teachers and administrators with the information required for informed planning, policy-making, and evaluation; in addition, a SIMS can assist in improving the efficiency and effectiveness of school.

Nwagwu (1995) on his study, commented on the relevance of information management in the school planning process by pointing out that records and records keeping constitute the arteries that support life-sustaining blood through the system and sub systems of institutions. He also emphasise that it will be impossible task to plan and administer any institution in which records are not kept or are carelessly and improperly kept. Nwagwu also argued that educational planners and administrators need to have adequate and accurate data on school enrolment, infrastructural facilities, personnel and other school data for effective planning and management of schools.

From the above authors we can see that SIMS have changed the roles of school managers as noted by (Pegler, 1992) and have changed methods of working in schools. Database of information of student's registration and family, discontinuity, grades, staff and classes and subject information improves efficiency of school managements. The school management information system can change school management in area of leadership, decision making, workload, human resources management, communication, responsibility and planning (Gur, 2000).

In a nutshell, a school information system is the best tools that can help a school and parents work together to promote student learning and success. It should be designed to help a school "increase success and decrease failure" as per Jenkins's (2003) expression. It should serve as a tool for collecting student progress data and for monitoring alignment with educational processes and continuous improvement of student learning which its ultimate goal is.

2.5 Obstacles to the Use of SIMS

Although there are many benefits that schools can have from having a SIMS, there are also obstacles to the proper use and implementation of SIMS in schools. The following are some of the obstacles to the proper use of SIMS as identified by some researchers.

One of the obstacles of the use of SMIS is computer illiteracy of the staff and the knowledge of how to use the system by the administrators and teachers, even in the developed world. This is because not all the teachers or administrators are keen on using ICT but they are forced to use it. Visscher and Bloemen (1999) in their study with 195 managers and teachers working in 63 high schools in Holland found out that school management information systems were mostly used in routine works and managers and teachers did not have sufficient education on the system. Managers and teachers indicated that while school management information systems had positive effects on evaluation of efficiency of the school, development of using sources, quality of educational programming and in school communication, it increased their workload and caused stress (Visscher, Bloemen, 1999).

Another obstacle is called computer phobia. Computer phobia is the fear of impending interaction with the computer that is disproportionate to the actual threat presented by the computer (Oetting, 1993). According to Oetting's work four variables are identified as a significant proportion of the variance in computer phobia in school environments, namely principal support of computer use, computer availability at school, perceived mathematical ability and whether the teaching personnel has received formal computer trainings. Computer phobia is unfortunately still current according to informal observation of schools environment.

Inadequacy of the number of computers at schools limits the use of SIMS in schools, if there is only one computer which is being used by the secretary or the principal, then teachers will have nowhere to use or access the SIMS application. A study conducted by Pelgrum (2001) in 26 countries and by Mentz and Mentz (2003) in schools of South Africa showed that one of the most important obstacles of the application of management information system was the inadequacy of the number of computers in schools. For that it can be said that the infrastructure problem hinders the realisation and the proper use of school management information system in today's schools, more especially in developing countries.

Limited funds in school are also one of the obstacles of fully using SMIS. Schools need funds to buy computers and software, for sustaining on-going professional development, technical support, equipment upgrades and regular maintenance. This was confirmed by MacNeil & Delafield (1998) who found out that the main inhibitors to implementing technology in the classroom are lack of financial resources for hardware, software, and infrastructure, and lack of time for professional development and planning, in the study they did in Texas USA where 120 principals and assistant principals were surveyed. The same can be applied to the availability and the use of SIMS in schools and more especially in developing countries.

In Namibia the government is not currently budgeting for the purchase of school computers or for necessary learning support materials or systems, but it does facilitate donor funding for school provision by an NGO. Many schools use school funds to buy or supplement and enhance supplies and teachers to teach computer literacy, while others seek sponsorships or receive donations (Chisholm, et al 2004). Many poorer schools in rural areas do not have funds and even the resources to provide the back-up necessary to compensate for low bandwidth, erratic electricity supplies and technical and maintenance support even for the computers or software donated.

The benefits of SIMS have outweighed the obstacles and the limitation of proper use of SIMS. Therefore the benefits should be recognised so that the maximum effectiveness of SIMS can enhance or improve school administration.

2.6 School Information Management System Design and Development

Various authors have discussed the design and development methodologies for information management. Eardley et al. (1995) described the methodologies as process-driven, data-driven and user–driven development systems. They explain that process-driven approach emphasises, functional decomposition, which includes the strategic, tactical and operational transactions.

Data-driven approaches concentrate on what Gerritsen and Zisman (1976) illustrate by means of the structure and the designer's model of the organization's database. They describe the relationships as one-to-one, one-to-many, and many-to-many. This model determines which data is to be stored and what relationships exist between data elements. The model exhibits three important features: the entities, attributes and relationships. The identification of entities and their relationships facilitates the drawing up of a logical data structure (Downs, 1992).

The user-driven methodologies emphasise partnerships between users and analysts (Eardley et al 1995). Whereby users of the system are involved in the development of the system (involved in system creation, on-going development, through open ended interviews, problem definition, paper prototyping, user testing, and rapid iteration).

Ives (1991) described three main elements of an information system structure as being a strategy, information systems and current and predicted information flows. He notes that an information system structure depends heavily on the scope and continuous review of the service requirement of the operations. Some of the rules for successful design of an information system structure described by Ives (1991:139) are:

- Involve the perspective of users;
- Design systems that adhere to key industry standards;
- Build scalability into a system to avoid being forces into premature system redesign;
- Design for maximum usability;
- Design networks around departmental and central repositories for business information;

- Design for system uptime, reliability, effective backups and recovery procedures to guard against loss of data;
- Integrated Information Management System.

The design of an information system should integrate people, organisations, technology, and the socio-economic, technical and political environments. Hence standardization of procedures in terms of policy, strategy, uniformity, access, coordination strategies in various systems and subsystems; and most of all proper identification of information to be coordinated into the system required (Pedrides, 2004).

Fulmer (1995) suggested in order for a School Information System to be utilized effectively, it should be designed through the conductive process that includes stakeholders from all levels of the organization in order that users will take ownership of the system and actually use it. According to Nolan (1996), effective utilisation of an information system depends as much on the strategy for developing the system, the methods of supporting its implementation, and the mind-set of its users, as it does the technical attributes of the system itself.

Therefore a SIMS should be designed in a process and or method that will make the system affordable, user friendly and robust. User centred design should be used through the project of developing the school system.

2.7 SIMS Technology

2.7.1 School Computer Infrastructures
Schools may have computer infrastructures such as Local Area Networks (LAN), Wireless connection to Internet, servers and personal computers. Computer laboratories in schools are connected to a network and sometimes to a server where they can access certain applications, share data and share printers.

In Namibia, Schoolnet provides schools with computers and computer laboratories infrastructure. The package of Schoolnet (schoolnet.na) consists of a server with free

software, a network of 5, or 10 or even 20 computers, 24/7 free Internet access, appropriate furniture and support and training. Internet connection is done via dial-up telephone modems. This connection is proving too expensive for most schools and Internet performance is too slow for realistic access to the web. Wireless network solution is installed in some areas (such as Ondangwa / Oshakati) with the aim to improve performance and lower cost of connections. For school without electricity, the installation of solar power was considered with about seventy-five schools identified (schoolnet.na).

Currently Schoolnet has connected more than 200 schools, with approximately 2000 installed computers. All computers have been donated to Schoolnet by Namibian organisations, or through international Non-Governmental Organisations (Manufacturing Consultancy Services, schoolnet.na).

2.7.2 Technologies Used in SIMS

The technology used in developing SIMS application varies, and it grows and evolves as technology is also changing. SIMS can be developed to be access as stand-alone applications, client-server applications or web-based applications. The following are the descriptions of technologies for SIMS

Stand-alone SIMS **–** a stand-along application is the one that deploys service locally, uses the services, and terminates the service when they are no longer needed. Services locally deployed by this application are not available to any other application; in addition, no remote service is available. SIMS software that is designed as stand-alone application can be installed on one computer and be used for school management, some stand alone SIMS are designed to be shared just to provide the flexibility. Example is the SchoolWrite software, TS School (schoolwrite.com, tsschool.com).

Client-Server SIMS – A client-server application is a piece of software that runs on a client computer and makes request to a remote server. Such applications are database applications that make database queries to a remote central database server. SIMS designed to be installed on the server and client computer can access the application from the server. This enables the data to be shared with multiple users. Davey (1997) on the

experiences in Australian schools showed that a client/server for Information Technology in Education (ITEM) produced an integration of information system.

Web-based SIMS – The netsity.com website defines a web application as a software package that can be accessed through the web browser. The software and database reside on a central server rather than being installed on the desktop system and is accessed over a TCP/IP network. Web based application are also client server type of application. This type of technology allows the application to be accessed anywhere through Internet and anytime. It makes the application easy to use and to be implemented without interrupting existing work process.

The web – based SIMS are now hosted either on the Internet or on the intranet of schools. For example a commercially SIMS software called E-School System can be accessed on the internet, making it accessible anytime and anywhere (calorisplanitia.com).

Other current or emerging web-based technologies are variations of Cloud Computing, including Software as a Service (SaaS), Virtual Desktop Infrastructure (VDI), thin client technology (sungard.com). SaaS is a software delivery model in which software and its associated data are hosted centrally on the Internet and are typically accessed by users using thin client, and normally web browser on the Internet. It is this way that most schools in developed countries are going with SIMS. A commercially solution called SaaS for K-12 School is a native to the web, providing the benefits of an integrated, student management and district administration system without the high cost of a complex IT infrastructure. The solution provides an application service where the specialist provider runs and maintains the school applications in a secure environment. All the school needs is a Local Area Network (LAN) and a high-speed Internet connection (sungard.com).

The web-based technology is the one leading in application development today. SIMS development has also come forward to make use of the web to expand education software and widen the effectiveness of the education system. But some schools still face some challenges of web-based online application, because of the Internet infrastructures (especially countries where Internet facility is still at a growing phase). According to (dreamteam.co.in) to address that challenge the concept of an intranet based system that

works offline and can synchronise with online interface is something that works and the developers of SIMS should consider (dreamteam.co.in).

2.8 Namibia Case

2.8.1 Namibia School System

Since 1990 (after independence), Namibia has made progress in overcoming the insufficient and unfair educational situation of colonial apartheid. In terms of quantity, Namibia has been able to improve a lot. Schooling facilities have been build, renovated or expanded and the number of teachers increased by 30%, the number of learners increased and the learner-teacher ratio improved as well. In 2006, more than 95% of the Namibian school age children were going to school (Fischer, 2010).

There are currently over 1500 schools in the country, of which about 100 are private schools, mainly farm schools (Fischer, 2010).

The formal school system in Namibian government schools consists of 12 years of schooling broken down as follows:

- Fours year of lower primary (Grades 1-4), using mother tongues as a medium of instruction;
- Three years of upper primary (Grade 5 -7) English as a medium of instruction starts in Grade 4 and goes up to Grade 12;
- Three years of junior secondary school (Grade 8-10);
- Two years of senior secondary school (Grade 11-12).

The formal school system structure may also be divided into the following phases some of which have combined phases.

- Primary phase

  This phase consist, of Lower Primary (Grades 1-4) and upper Primary (Grade 5-7). The policy of continuous assessment based on a set of competencies that learners are expected to acquire, provides the basis for the promotion of

learners from one grade level to the other. A national Grade 7 examination in Mathematics, English and Science is introduced to help monitor learner acquisition of the basic competencies in key subjects at the end of the primary phase.

- Secondary phase

The secondary phase consists of Junior Secondary, catering for Grade 8-10 and the Senior Secondary, which caters for Grade 11 and 12. Learners write a National Examination called Namibia Senior Secondary Certificate (NSSC) which was developed from the International General Certificate of Secondary Education (IGCSE) and the Higher International General Certificate of Secondary Education (HIGCSE) in collaboration with the University of Cambridge Local Examination Syndicate (Mutorwa, 2004) The NSSC examination serves as an exit level from the Namibian school education system.

- Combined phase

These are schools offering both Primary and secondary or Senior Secondary grades under one roof. Very few of the combined schools offer complete primary and secondary level programme.

Namibia has approximately 1500 schools with an average growth of 1.0 %.(EMIS, Statistics report, 2008). Table 2.1 gives the Numbers of schools, learners, teachers and support staffs as of 2008 report. Looking at the number of schools, learners and teachers, it shows that Namibia has relatively small schools in size. With the average of 345.2 of learners, 12.5 teachers and 2.4 support staff per school, it indicates how small the volume of data the school has to manage for SIMS software.

Table 1   Numbers of schools, learners, teachers and support staff

Region	Schools	Learners		Teachers		Support staff	
	Numbers	Numbers	% female	Numbers	% female	Numbers	% female
National	1,672	577,290	50.7%	20,830	62.0%	3,935	66.6%
Education regions							
Caprivi	97	26,850	48.4%	1,044	53.3%	274	81.4%
Erongo	61	27,154	51.4%	978	69.8%	274	63.9%
Hardap	55	20,470	50.9%	736	60.7%	236	69.5%
Head Office	9	1,576	41.5%	174	70.1%	46	50.0%
Karas	47	18,595	50.8%	713	68.9%	170	68.8%
Kavango	330	69,689	48.7%	2,472	43.6%	236	68.6%
Khomas	91	63,701	51.9%	2,384	72.9%	541	54.9%
Kunene	53	16,774	50.1%	649	51.8%	162	61.7%
Ohangwena	235	87,898	51.7%	3,024	61.5%	422	65.9%
Omaheke	40	14,661	50.6%	540	61.5%	105	67.6%
Omusati	269	87,221	50.8%	3,119	65.6%	557	78.6%
Oshana	132	52,077	51.0%	1,815	68.2%	327	71.6%
Oshikoto	188	57,402	50.7%	2,057	61.9%	336	61.9%
Otjozondjupa	65	33,222	50.7%	1,125	64.1%	249	53.4%

Figure, 2.1 Number of Schools, Learners, Teachers and Support Staffs (EMIS, Statistics report, 2008)

The Namibian constitution and the Education Act (2001) state the frame for the educational system: Compulsory school attendance exists for the seven years of primary school, respectively for children between the age of six and sixteen. School fees are not allowed for primary education. In the first three grades, the lessons are given in the mother tongue of the majority of the students. In grade four, the switch to English is to be introduced, so that from grade five on, English is the only language to be used for teaching and tests.

Teachers

Teachers in Namibia obtain their training and qualification in different education systems. There are four Colleges of Education (Windhoek, Rundu, Katima Mulilo and Ongwediva) in the country which train teachers. These four colleges have been taken over by the University of Namibia. The University of Namibia also provides teachers for senior secondary education.

Below is the table showing the number of schools with different numbers of teachers.

Figure, 2.2 Numbers of Schools with Numbers of Teachers
Source: http://www.nied.edu.na/publications/other%20resources/school%20cluster%20book.pdf

2.8.2 ICT in Education in Namibia

Consistent with the objectives of Vision 2030, the Ministry of Education in Namibia adopted an ICT policy for education in 2003 (Shafika, 2007). The priority area for the policy are colleges of education and related in-services programmes, schools with secondary grades, teachers education programmes, vocational training, primary schools, libraries and community centers. Some of the main objectives, of the policy are to produce ICT literate citizens and to improve the efficiency of educational administration and management at every level (Shafika, 2007).

The Namibian Ministry of Education has also developed an ICT initiative in Education organisation based on the ICT for education policy called TECH/NA!. The main goals of the organisation are to equip educational institutions with hardware, software, connectivity, curriculum, content and technical support; educate school administrators, staff, teachers, and learners in ICT literacy and ICT integration across the entire curriculum (tech.na).

The ICT Policy in Education has also developed a consistent forum to work together and engage all public, private and civil society partners. Because of this partnership most public schools in Namibia have at least a computer (Ilukena & Malone, 2006). The partners have donated computers to most public schools and provide them with access to Internet (Shafika, 2007). Many teachers, principals, and secretaries have also been and are still being

provided with computer trainings by many non-governmental organisations (NGOs) such as NIED, Schoolnet, NETSS, Tech/!Na, etc.

The following are some of the ICT initiatives and projects that are supporting schools in Namibia:

- The National Education Technology Services and Support (NETSS), is responsible for coordinating access to ICTs to all Namibian education institutions by overseeing the sourcing , refurbishment, installation and support for ICTs. It serves as a distribution hub for ICTs in education and a national helpdesk for technical support (Shafika, 2007).
- Namibia is also one of the four countries that have been supported by UN ICT, through the Global eSchools and Communities Initiative (GeSCI) that was set up by the UN Secretary General Kofi Annan (gesci.org).The initiative supports countries on ICT for education policy development, co-ordination, and implementation process (gesci.org).
- SchoolNet Namibia is a non-profit organisation that provide, sustainable, affordable open source technology solutions and Internet access as well as technical support, training services and creative common licensed educational content to schools, community –based education organisation and education practitioner throughout the country. SchoolNet Namibia has reached over 350 schools since 2000, which makes it a lead organisation in National ICT policy making (Shafika, 2007).

Looking at the Namibian government and private organization initiatives on ICT as stated above for education and the contribution of SchoolNet Namibia, we can say that most schools in Namibia have at least a computer. These computers are mainly used for computer literacy learning, and for writing official documents.

2.8.3 Educational Management Information System (EMIS)

Namibia also as a developing country has developed an Educational Management Information System for the Ministry of Education and Culture. The development of the system was done and started in the year 1990, when the need for records of schools, including their position and to provide the means of informing the process of expanding the provision of education. So the EMIS and the Geographical Information System (GIS) was developed, whereby the two systems run on Oracle Relational Database Management System (Voigts, 1999).

The data on the system is well maintained with educational data because of the consistent collection of educational statistics which is done in two annual surveys. The Ministry of Education EMIS department sends out questionnaires to schools for annual school census called the 15th school day statistics and for the Annual Education Census (AEC) via the Regional offices and their Inspectors to schools. The 15th school day statistics is intended to provide information for operational and planning purpose while, the AEC provide, information to monitor the state of education from year to year (Namibia EMIS Education Statistics, 2008). School principals return the forms to the inspectors who after checking them passed the questionnaires on to the Regional officer from where they are sent to the EMIS in Head office, in Windhoek.

According to Voigts (1999) the GIS containing the geographical co-ordinates of all schools and other relevant geographical information was also developed and linked to the EMIS. The GIS was used for several purposes in decision making such as to delineate inspection circuit and schools clusters, reallocating schools to regions after changes of boundaries, evaluating request for new schools and extension to schools, etc.)

The EMIS system is currently being used in many projects and policy development of the Ministry of Education, such as Namibia Text book policy to calculate the textbooks capitation allowance for schools. The EMIS system is mainly for central management of the Ministry of education and not at school level (Voigts, 1999).

2.7 Conclusion

The literature review above indicates that the concept of School Information System is not new in the world and many countries in the world have already implemented it.

The SIMS in Namibia is at the expansion stage where most of the schools have some stand-alone SIMS which are not integrated and are only used mostly by school secretaries. Namibia will move to the integration stage soon with the Ministry of Education in agreement with Edupac Software Support Service to develop an Educational management information solution where each educational institution could update live information on site and be able to be accessed and managed by school inspection circuits, regional offices and national departments.

SIMS can be defined in terms of Namibia context as a management information system that helps the schools with administration of learners, teacher records, learner's grade and report cards, a system that assists the principals and school administrators with the management of financial, human resources and physical resources in an efficient and effective manner. It should be a system that enhances and strengthens the collection and processing of information in all educational institutions and the analysis and distribution of information in a timely manner, while strengthening regional planning.

A school information system helps and benefits schools in many ways such as promoting student learning and success improve the efficiency and effectiveness of school management and increase the proper communication with parents. School information system can also provide principals with information required for informed planning, policy making and evaluation.

The design of the school system should involve the school users themselves for the system to be usable and be able to help schools.

Namibia has also started with the EMIS which is at the Ministerial Administration level. It is now time for Namibia to take a lead in developing their School Information System at the school level that is unique to their educational management system and policies. This is

necessitated by the need to have proper planning and control of school information and effective use of school recourses.

Therefore, the construction of a computer-assisted school information system for Namibian public schools is timely needed and shall realise the benefits cited in this project.

Chapter 3

3.   Methodology

This chapter provides the scientific basis for the research which has been conducted and for the design and implementation of the computer assisted school information system. It also explains the reasons for using various methods giving advantages and disadvantages of these methods. The chapter is organised according to the following headings objective, population and sampling, data collection methods, system development method and the conclusion.

3.1 Introduction

The purpose of this research is to develop a computer-assisted school information system which is unique to Namibian government schools and which will assist schools to reduce workloads in every area of school activities by automating many of the tasks undertaken by teachers, and administrative staffs each day at the school level. Therefore this chapter provides an overview of the methodological approaches and research design selected in order to develop the computer-assisted school information system.

The chapter is organised according to the following headings, objective, population and sampling, data collection methods, system development method and the conclusion.

3.2 Objectives

The objective of this chapter is to discuss the methods used to achieve, the main objective of the research, which is to develop a computer-assisted information system for Namibian public schools (primary and secondary), which is unique to Namibia and will assist schools to reduce the workload in area of school activities by automating many of the tasks undertaken by staffs. Another objective of this chapter is to provide a framework for the author to ensure validity and reliability of the findings.

3.3 Population and Sampling

3.3.1 Population

A research population is generally a large collection of individuals or objects that is the main focus of a scientific query. It is for the benefit of the population that researches are done. According to Castillo (2009) a research population is also known as a well-defined collection of individuals or objects known to have similar characteristics. All individuals or objects within a certain population usually have a common, binding characteristic or trait. The general population of this study was the public (government primary and secondary schools employees), whereby teachers, secretaries and principals were interviewed.

3.3.2 Sampling

Sampling is the process of selecting units from a population of interest so that by studying the sample and understanding the properties of the characteristics of the sample subjects, the properties may be generalised to the population element (Trochim, 2002).There are many sampling methods that can be used such as: Random sampling, systematic sampling, stratifies sampling, cluster sampling, haphazard sampling, and judgemental sampling. In judgmental sampling, the person doing the sample uses his/her knowledge or experience to select the items to be sampled (Collins, 1999).

In this study, judgmental sampling method was used to select schools that were interviewed. Six Namibian public schools were selected. The seven schools were then interviewed and their manual administration system investigated. The schools that were interviewed were three (3) in Khomas region (central), one (1) in Otjikoto region (North), two (2) in Omusati region (North). Three Primary schools were interviewed while the rest were secondary schools. This decision was made because the focus is on public schools which use the same administration procedure as designed by the government.

Schools were selected based on the following criteria:

- Schools that have the reputation of following government procedures;
- Schools with computers being used full time;

- Schools with a pass rate 35% of grade 10 and or grade 12The criteria for school with pass rate of 35% was selected just for secondary schools so that the research can be done on at least better schools with average performance.

3.4 Data Collection Methods

The following methods were used for collecting data.

3.4.1Questionnaire

A questionnaire is a pre-formulated written set of questions to which respondents record their answers, usually within rather closely defined alternatives (Sekaran, 2000). A sample of respondents is asked to respond to a structured sequence of questions. Questionnaires are very cost effective when compared to face-to-face interviews. The data collected from the questionnaire are easy to analyse. Another important advantage of the questionnaire is that it reduces bias. (Sekaran, 2000).

In this study a questionnaire was used to obtain general information about the schools, like the name of school, type of schools, learner's population, departments and subjects offered at schools.

3.4.2 Face to Face Interview and Telephone Interviews

Kvale (1983, p.174) defines the qualitative research interview as "an interview whose purpose is to gather descriptions of the life-world of the interviewee with respect to interpretation of the meaning of the described phenomena". Frey and Oishi (1995, p. 1) define an interview as "a purposeful conversation in which one person asks prepared questions (interviewer) and another answers them (respondent)" This is done to gain information on a particular topic or a particular area to be researched.

Collection of the descriptions and information can be done in several ways such as face-to-face interviews and interviewing by telephone. These types of interviews are called structured interviews. A structured interview is a data-gathering method that involves a standard set of questions asked in the same manner and order. For example an evaluator

ask the same questions of numerous individuals or individual representing numerous organization in a precise manner, offering each interviewee the same set of possible responses (Nichols, 1991). Structured interview makes the evaluation and comparison of data easier and it enables standardisation of the research data. It also provides reliable source of qualitative and quantitative data i.e. it improves validity and reliability of the data.

Structured interview was used in this research. Face-to-face and telephonic interview was used to interview school teachers, principals and secretaries about the manual administration of the schools. The questions for the face-to-face interviews were divided into several categories: Learner's record management, Teacher's record management, Learner's mark management, Learner's school reports, Reports for the inspector's office, Attendance register, Classroom management, and School events management.

Arrangements of interviews were done with respect for the interviewee's convenience, by seeking an appointment in advance. Attempts were made to let the interviewee know exactly what questions were to be asked, in what form the question would be posed and the method by which the data would be accurately recorded. This was done to enlist respondent's co-operation. The responded were helped to understand and appreciate what was being studied and its implication for the overall development of the school.

3.4.3 Study of the Ministry of Education EMIS Questionnaire, EMIS Statistical Report   Book

The Ministry of Education EMIS questionnaires and statistic report were analysed and its requirement was incorporated in the design of the system. This will enable the system to help school administrators in filling the EMIS questionnaires easier.   School subjects Continuous Assessment sheets (CAS) for different subjects were also studied for the implementation of the learner's mark management module.

3.4.4 Focus Group

Focus group involves a group of people coming together to share thoughts, feeling, attitudes and ideas on a certain subject. Advantages of focus group is that researcher can

interact with the participants, pose follow-up questions, get information from non-verbal responses, such as facial expression or body language (David, 2007).

Courage and Baxter (2005) recommend focus groups as a means of drawing multiple viewpoints in a short space of time.   They state that focus groups create synergy between participants and create a platform for brainstorming. They also add that focus groups allow researchers to understand the needs of the group as a whole as opposed to the needs of individuals as in interviews. Courage and Baxter (2005) argue that the disadvantage of focus groups is that participants are likely to influence each other's opinions, and the researcher is limited in the number and depth of questions asked.

For this project a focus group was created which consist of two teachers, one principal and one secretary. The group was used in the design of the system interface.

3.5 System Development Methods

System development methodologies are promoted as a means of improving the management and control of the software development process, structuring and simplifying the process, and standardising the development process and product by specifying activities to be done and techniques to be used (nos.org). It is assumed that the use of system development methodology will improve the system development productivity and quality.

In this section two types of system development methodologies are discussed, which are Prototyping Software Lifecycle Method and the Dynamic System Development Method.

3.5.1 Prototyping Software Lifecycle Method

The prototyping method starts with the requirement gathering. The basic idea (productdevelop.blogspot.com) is that instead of freezing the requirements before design or coding can precede a throwaway prototype is built to understand the requirements. It is

argued that (productdevelop.blogspot.com) this method is ideal for complicated and large systems for which there is no manual process or existing system to help determining the requirement. It is the effective method to demonstrate the feasibility of a certain approach.

Advantages of Prototyping Software Lifecycle Method

The following are the advantages as described by Freetutes website (Freetutes, The tutorial website, n.d.).:

- Users are actively involved in the development;
- It provides a better system to users, as users have natural tendency to change their mind in specifying requirements and this method of developing systems supports this user tendency.
- Since in this method a working model of the system is provided, the users get a better understanding of the system being developed.
- Errors can be detected much earlier as the system is mode side by side.
- Quicker user feedback is available leading to better solutions.

The productdevelop.blogpost.com has identified the following as advantages of prototyping model:

- It is good for developing software for users who are not IT-literate;
- Quicker user feedback is available leading to better solutions;
- Reduces time and costs;
- A system requirement specification will be frozen after obtaining the feedback from the user, this is to make sure the new requirement is considered and incorporated;

- The prototyping model is useful in situation where requirements and user's need are not clear or poorly specified. It benefit is that it helps in specifying the requirement and it can also incorporate new technologies that are identified during the project. The model provides the system is a short time and reduce the cost needed for the project.

In my opinion the prototyping model is useful in situation where requirements and user's need are not clear or poorly specified. It benefits are that it helps in specifying the requirement and it can also incorporate new technologies that are identified during the project.

Disadvantaged of Prototyping Software Lifecycle Method

The following are the disadvantages as described by (Freetutes, The tutorial website, n.d.).:

- The method leads to implementing and then repairing way of building systems;
- Practically this methodology may increase complexity of the system as scope of the system may expand beyond original plans.

The productdevelop.blogspot.com has described the following disadvantages of prototyping development model.

- That customers (users) could believe the prototype as the working version;
- Users can begin to think that a prototype, intended to be thrown away, is actually a final system that merely need to be finished or polished;
- Excessive development time of the prototype: this happens if the developers lose sight of the fact that prototyping is supposed to be done quickly, and they try to develop a prototype that is too complex;
- Expenses of implementing prototyping- that the start-up costs of building a development team focused on prototyping may be high.

The biggest disadvantage of the prototyping method is that of the users thinking the prototype is the final system that merely needs to be finished of polished. This is dangerous because it can lead to users to expect the prototype to accurately model the performance of the final system when this is not the intent of the developers. Users can also become attached to the features of the prototype that were included for consideration and then removed from the specification for a final system. If users are able to require all proposed features be included in the final system this can lead to conflict.

Another disadvantage of the prototype method could be the developer's attachment to a prototype. This can lead to problems like attempting to convert a limited prototype into a final system when it does not have appropriate underlying architecture.

In conclusion, it has been found that prototyping is very effective in the analysis and design of online-systems, especially for transaction processing, where the user screen dialogs is much more in evidence. The greater the interaction between the computer and the user the greater the benefit is that can be obtained from building a quick system and letting the user play with it (Crinnion, 1991).

Prototyping method is found not to be good for development of systems with little user interactions, such as batch processing or systems that mostly do calculations. This is because sometimes the coding needed to perform the system functions may be too intensive and the potentials gains that prototyping could provide are too small (Crinnion, 1991).

3.5.2 The Dynamic System Development (DSDM) Method

DSDM method is a framework based originally around Rapid Application Development (RAD), supported by its continuous user involvement in an iterative development and incremental approach which is responsive to changing requirement, in order to develop a system that meets the business needs on time and on budget (Freetutes, The tutorial website, n.d.).

Advantages of DSDM as described by Freetutes website (Freetutes.com);

- Active user participation throughout the life of the project and iterative nature of the development improves quality of the product;
- DSDM ensures rapid deliveries;
- Both of the above factors result in reduced project costs.

Disadvantaged of DSDM (Freetutes, The tutorial website, n.d.);

- It is relatively new model. It is not very common so it is difficult to understand.

For this research a DSDM method was selected because of the rapid delivery of the system and this research has limited time. The DSDM method is able to deliver basic functionality quickly with more functionality being delivered at regular intervals. It also provides constant feedback from the users, that the system being developed is more likely to meet the need it was commissioned for.

The DSDM method consist of the following stages: Feasibility study, User requirement and System Specification, Design and Build iteration and Implementation. These stages for this research are described below.

3.5.1 Feasibility Study

A feasibility study is defined as an evaluation or analysis of the potential impact of a proposed project or program. It aims at assisting in decision makers in determining whether or not to implement the project or program. It is based on extensive research on both current practices and the proposed program or project (Businessdictionary.com).

A feasibility of this project for the use of DSDM was examined. Prerequisites for the use of DSDM were addressed by answering questions like: 'Can this project meet the required school needs?', 'Is this project suited for the use of DSDM?' and 'What are the most important risks involved?' The most important techniques that were used in this method were analysing data from schools.

Free tools for constructing the system was investigated and analysed to see if they fit for the construction of the system. School statistics from the EMIS report was also analysed. Free school tools or software were also analysed and seen how they could help in the design of the Namibian school information system.

3.5.2 Requirement Analysis and System Specification

A requirement analysis is the process that comes after data is gathered, structured analysis is then done on the data in order to arrive at models of the system to be developed. The process makes the stated and unstated requirement of the system to be developed clear, complete, unambiguous and detailed enough. The system requirement is then documented (Blanchard & Fabrycky, 1990).

A system specification is the process where the specification of the system to be developed is done. It specifies the structure of the system (how it is organised), the functions (what the

system will do), behaviour (how the system responds to events and stimuli, data (the meaning and the organisation of data).

Blanchard & Fabrycky (1990) also state that system specifications serve as benchmarks for evaluating design as well as their implementation. They also facilitate quality assurance via verification (are we building the system right, i.e. do the design and implementation meet the specifications?) and validation (are we building the right system, i.e. does the system meet the user needs?

In this phase the overall requirement analysis of the desired system was done. The user requirement was defined and analysed and a requirement definition document was drawn, based on the data from the interviews.

The Ministry of Education EMIS questionnaire was also analysed and incorporated on the system specification. A System Specification document was written out, to resolve the ambiguities and to precisely describe the capability of the system. User case diagrams were used to explain the requirement and specification better (Le Vie, Jr. (n.d.).

3.5.3 Designing of a Database and User Interface

3.5.3.1 Database

A database is a collection of data that is organised so that it can be easily accessed, managed and updated. A relational database contains tables that are related; related tables contain fields that match. By using a relational database, each piece of information only needs to be stored once.

A properly designed database provides access to up-to-date, accurate information. It also enables the organisation to achieve its goals because the organization needs are met and the system can accommodate changes (smart-it-consulting.com).

Designing a database involves the following steps:

Data Analysis**:** on this step data requirement for an organization is defined and all the data that is intended to input and modify in the database and expected outputs are listed (Progress Software Corporation, 2001).

Logical design: on this step, each piece of information that needs to be tracked and the relation among them is described. This can then be verified for completeness and accuracy. The tables for the database are defined; the relationship between tables, normalisation of tables and determination of primary key is done (Progress Software Corporation, 2001).

Physical database design: this step refines the logical design. Examination of how the user access the database, how data will commonly be used, which column in the table should be indexed and where flexibility should be build and how and where to allow growth is done on this step (Progress Software Corporation, 2001).

In this project all the three steps described above were used, where the Data analysis was done on the phase of System requirement and System specification, and an ER Diagram and the Data Modelling were done.

3.5.3.2 User Interface Design

A user interface is the part of the computer system with which the user interacts with, in order to use the system and achieve his or her goal (elsevierdirect.com). A good user interface design is needed to encourage an easy, natural and engaging interaction between a user and a system and it allows users to carry out their required tasks.

User –centred design

This is an approach to user interface design and development that involves users throughout the design and development process. It focuses on understanding the users of a computer system under development and an understanding of the tasks that users will perform with the system and the environment in which they will use the system (nextlab.mit.edu).

Below are some of the User Interface designs that a good user interface design should have as described by Sommerville (2004).:

- **User familiarity**: The interface should use terms and concepts which are drawn from the experience of the people who will make most use of the system. Meaning the interface should be based on user-oriented terms and concepts rather than computer concepts.

- **Consistency:** The interface should be consistent in that, wherever possible, comparable operations should be activated in the same way. That commands and menus should have the same format, command punctuation should be similar.

- **Minimal surprise:** Users should never be surprised by the behaviour of a system. If a command operates in a known way, the user should be able to predict the operation of comparable commands

- **Recoverability:** The interface should include mechanisms to allow users to recover from errors. This might include undo facilities, confirmation of destructive actions, 'soft' deletes, etc.

- **User guidance:** The interface should provide meaningful feedback when errors occur and provide context-sensitive user help facilities. Some user guidance such as help systems, on-line manuals, etc. should be supplied.

- **User diversity:** The interface should provide appropriate interaction facilities for different types of system user. For example, some users have seeing difficulties and so larger text should be available.

The smashingmagazine.com website also describes the qualities that make a good user interface as below:

- Clarity. That the interface avoids ambiguity by making everything clear through language, flow, hierarchy and metaphors for visual elements;
- Concision. That the interface is concise and clear;

- Familiarity. Something is familiar when you recall a previous encounter you've had with it. Even if someone uses an interface for the first time, certain elements can still be familiar;

- Responsiveness. This means a couple of things. First, responsiveness means speed: a good interface should not feel sluggish. Secondly, the interface should provide good feedback to the user about what's happening and whether the user's input is being successfully processed;

- Consistency. Keeping your interface consistent across your application is important because it allows users to recognize usage patterns;

- Aesthetics. Making the interface look good will make the time users spend using the application more enjoyable; and happier users can only be a good thing;

- Efficiency. An interface that allow the user to perform tasks with less time and effort by doing most of the work for the users;

- Forgiveness. A good interface should not punish users for their mistakes but should instead provide the means to remedy them.

Most of the above features of user interface are supported by other researchers. Hobart (1995) has described the 12 principles of a good user interface designs of which some of them are user control, clarity, consistency, visual feedback, keeping text clear, provide traceable paths, and provide keyboard support.

User interface design should aims to enhance the visual, usability and technological qualities of an interface. It should add to the satisfaction of the person using a product or a system. Therefore successful user interface designs should have the following qualities which are usefulness, learn ability, efficiency, and ease of memorization, reliability and user-friendliness. The design of the user interface should involve the users of the system in order for the design to be effective and be of quality.

A user-centred approach of User interface design was used in this project. The following activities were carried out in the design of the system user interface:

User analysis, whereby the understanding of what user will do with the system, was done.

System prototyping: paper based prototype was done and discussed with the focus group and then a system prototype was finally developed and evaluated with the members of the focus group.

3.5.4 Creation of the System Prototype

In this phase, the system prototype was developed, the design of the database and user interface was implemented. The coding of the database and the user interfaces was done using Oracle 10G Express, running on a Windows platform. The windows platform was chosen because it is the only platform available, but the system is able to run in any platform since it is a web based system.

The prototype was only tested by the developer with the test cases that she created. User documentation and test records were developed to help in the final implementation. Guidelines with respect to the implementation and use of the system were also created.

3.5.5 Implementation and Evaluation

This phase reviewed the impact of the implemented system on schools; the central issue was whether the system met the goals set at the beginning of the project. Three other activities were to be done during the phases which were:

- User approval: the focus group members approved the tested system for implementation and guideline with respect to the implementation and use of the system developed;
- Train Users: the focus group members got trained on the use of the system;
- Implementation: The system to be implemented at the schools of the focus group members. System performance to be compared to performance objectives established in the system specification document. This phase continues until the system is operating in production in accordance with the defined user requirements and system specification.

The only evaluation that was done is the developer's evaluation, where the system was compared to the functional requirements and checked if the requirement was met. Users did not approve nor trained on how to use the system.

3.4 Conclusion

The purpose of this research is to develop a computer-assisted school information system which is unique to Namibian government schools. The system is unique in such a way that it supports the structures and procedures of the Ministry of Education, in the use of CAS (continuous assessment) sheets, requirements of the reporting of schools, requirement of the EMIS questionnaire, and system with default subjects and departments that are supported by the Namibian Education system.

The population of the research was the government primary and secondary schools employees whereby teachers, secretaries and principals were interviewed. A judgmental sampling was used to select schools that were interviewed on which three schools were from Khomas region, one from Otjikoto region (North), two from Omusati region (North).

The questionnaire, face to face interview, focus groups and a study of the Ministry of Education EMIS questionnaire were used as the data collection method for the research. A Dynamic System Development method was selected and used in the design and implementation of the system, because of its rapid delivery of systems.

The next chapter present analyses of data collected from questionnaire, interviews and analysis of Educational statistical report. System specifications and designs are also presented on this chapter and procedures of how the final system was developed.

Chapter 4

4.   Findings

This chapter deals with the presentation and analysis of the results of the questionnaire, interviews and the feasibility study that was done. The chapter commences with the presentation of the questionnaire results and its discussion. This is followed by the presentation of the results of the interview. Furthermore the chapter presents the summary of the feasibility study, and pointing out the significance of the system to be developed and then the conclusion.

4.1 Introduction

The purpose of this research is to develop a system for the Namibian government schools to administer their schools. Some of the sub-objectives of this research are to collect data on how government schools are actually administered, and analyse these data and use them to define and design the system for government schools. Another sub-objective is to study and analyse the free software tools for constructing the system component database and front-end (interface).

This chapter presents and analyses the data collected from the questionnaire and from the interviews conducted. It also presents the result of the feasibility study conducted for the development of the computer assisted school administration for Namibian government schools. The free tool that was analysed and found suitable for the design of the system is also presented.

Six schools were interviewed using a face-to-face technique and filled in the questionnaires. Principals, teachers and secretaries were interviewed on how they administer the school learner's records, teacher's records, and learner's attendance, school reporting handling, school events managements, and school fee payment management. The schools represents from all type of schools: primary, secondary and combined school from various regions. Five questionnaires were handed to each school that was interviewed; two were answered by

principals, two by secretaries and two by teachers. The entire questionnaire was returned and 100% questions answered.

The EMIS statistical report was also analysed to see how it can help in the design of the system.

4.2 Questionnaire Findings

4.2.1 General Information about the Schools

Table 4.1 below presents the information of the schools that were interviewed and filled in the questionnaire. The schools range from all types of schools in Namibia, (primary, combined and secondary schools). It also shows the number of teachers each school has, the schools have the same departments because they are government schools and they follow government structures. Subjects without departments are subjects that do not belong to any department that the school have, so the schools decide to put them on whichever department that they feel fit. Some teachers at KMSP School are also involved in school administration. The school calls such teachers as class group leaders. E.g. they have 3 grade 3 classes, so for grade 3 they choose a class group leader who will be involved in the admission of grade 3 learners and in allocating grade 3 learners to classes during registration at the beginning of the year.

Table 4:1 General Information of School Interviewed

Name	Type of school	Grades	No. of Learners	No. of teachers	School administration	Departments	Subjects without departments
OTJS (Otjikoto region)	Secondary	8-12	1100	31	Secretaries, principals	Commerce, Science, Language, Social studies	History; Physical Education, Life skills, Religious and Moral education
KMSS1 (Khomas region)	Secondary	8-12	1062	37	Secretaries, principal	Commerce, Science, Language, Social studies	Life skills
OMUP (Omusati region)	Primary	0-7	586	21	Secretaries, principal	Lower primary, Mathematics and Science	Social Science, Oshindonga, English
KMSS2 (Khomas region)	Secondary	8-12	1000	35	Secretaries, principal	Commerce, Science, Language, Social studies	Physical education, Life skills, Art + culture
OMUC (Omusati region)	Combined	1-10	300	12	Principal, secretary	Lower primary, Mathematics and Science, Commerce, Social Science, Language	Physical Education, Life skills
KMSP (Khomas region)	Primary	1-7	1300	39	Principal, teachers, secretaries	Lower primary, Social science, Mathematics and science	Life Skills; Physical Education
Total			5034	175			
Average			839	29.2			

OTJS –Otjikoto Secondary KMSS1 –KhomasSecondary 1 OMUP –Omusati Primary KMSS2 –Khomas Secondary 2 OMUC- Omusati combined KMSP –KhomasPrimary

The average of number of learners and number of school is 839 and 29.2 respectively, indicating how schools in Namibia are relatively small.

4.2.2 Number of Computers in Schools and Internet Connections

The number of computers in each school varies significantly. Table 4.2 illustrates that the two schools in rural areas have only one computer each which is mostly being used by the secretary do not have internet connections. All the schools use private consultant for maintenance of computers and use their school funds for maintenance payment. The KMSP School has six computers and four laptops bought from the school fund. All the KMSP computers are being used two by the secretaries, one by the school principal, four by the HODs, and the rest by the teachers. KMSP, OTJIS, and KMSS1 have wireless internet connection provided by Telecom Namibia. All the schools pay for the computer maintenance and internet connection fees from the school fund. KMSP has no computer laboratories but they use to hire a company to come and teach the learners computer literacy after school. Only the secondary schools from the schools interviewed have computer laboratories where learners are being taught computer practice.

Table 4.2, Numbers of Computers in Schools and Internet Connection

School	No. of computers	Location of computers	Internet connection (yes, no), type of connection	Who does the maintenance of computers	Who pays for computer maintenance	Who pays for internet connection	No. of computer laboratories
OTJIS	88 bought with school development fund	Classrooms, comp labs, library, secretary office, staff room, principal office	Yes, downlink ADSL , Telecom Namibia	Private consultant	School fund	School fund	3
KMSS1	33 funded and bought by the school	Lab, secretary office, staff room, principal office	Yes, downlink ADSL , Telecom Namibia	Private consultant	School fund	School fund	1
OMUP	1 funded	Secretary office	No	Private consultant	School fund	n/a	0
KMSS2	Funded and bought by school fund	Classroom, computer labs, library, secretary office, staff room, principal office	No	Government	government	n/a	2
OMUC	1 funded	Secretary office	No	Private consultant	School fund	n/a	0
KMSP	10 bought by the school	Secretary office, staff room, principal office	Yes, downlink ADSL, Telecom Namibia	Private consultant	School fund	School fund	no

4.2.3 Computer Uses in Schools

The questionnaire data suggest that the schools use the computers in the following ways as also shown in figure 4.1:

- Administration
- Teaching and learning
- Computer practice teaching

- Internet browsing

- Project and assignments

- E-mail

- Presentations

- Educational games

Figure 4.1 reveals in more details on how schools use computers. All schools use computers for administration and only one school uses computers for education games. Three schools, OTJIS, KMSS1, and KMSS2 which are secondary schools incorporate computer literacy in their curriculum. The figure also shows that all the school interviewed use the computers for school administration, which is the main focus of this research.

Figure 4.1, The Uses of Computers in Schools

4.2.4 Number of Computers Used by Each Category of Each School Population.
Figure 4.2 shows that computers in school are used by almost each category of users which are teachers, learners, principals, secretaries and HODs. Only schools with one computer used it by secretary. Those schools are OMUP and OMUC.

Figure 4.2, Numbers of Computers Used by Categories for Each School

4.2.5 Administrative Software Used in Computers in Schools

Table 4.3 below gives details of the name of software the schools use for administration and how they print out school reports. Most of the schools use software called SchoolWrite to administer and print the learner's reports. Another software that the school use for timetable is called aSC Timetable, but these software are illegal (no licenses purchased) as mentioned by one of the school principal during the interview. KMSS1 use module of SchoolWrite for their finance management while KMSS2 use the SchoolWrite module for finance and timetable. KMSP is in the process of buying software called Pastel Accounting for managing school finances; this is according to the secretary when she was interviewed.

Table 4.3, Administrative Software Used in Computers in Schools

School	School database (yes/no) and name	How is the Time table generated, software used if any	How School report generated and printed	How is school Financial managed	Other, software used for school administration
OTJS	Yes, SchoolWrite V 3.3.7	Manual	School write, installed inWindows	Manual, using spreadsheets	None
KMSS1	Yes, SchoolWrite V 3.3.7	manual	SchoolWrite, installed in Windows	SchoolWrite	Yes, in the process of changing to School link,
OMUP	no	aSC Timetable	Manual, writing of government school reports	manual	None
KMSS2	Yes, SchoolWrite V 3.3.7	SchoolWrite	School write, installed in Windows	School Write	none
OMUC	No	aSC Timetable	Schedule & Report, installed in Windows	manual	None
KMSP	Yes, SchoolWrite V3.3.7	manual	School write 3.3.7, installed in Windows	No, use manual process (in the process of purchasing Pastel Accounting	none

4.3 Findings from the Interview:

The interview questions were categorised according to the following groups: Learner's record management, teacher's records management, learner's mark management, learner's school report handling, attendance register of learners, classroom allocations, school fees payment management, school event management. The findings from the interview are presented below according to categories above.

4.3.1 Learner's Record Managements

All the schools interviewed require a learner to fill in an application form in order to be admitted to the school. The schools use application forms designed by the Ministry of Education; some schools have modified the government application forms to contain their school logos. Three out of the interviewed schools have admission committee which evaluates the application forms and process the admission of learners. KMSP school

admission is done by class teachers together with their HODs. OTJS admission is done by the principal and the HODs.

Four schools (OTJS, KMSS1, KMSS2, and KMSP) have school databases where they keep learner's details. In these four schools, the learner's details are stored twice, in the database and on the paper files. The other two schools (OMUC and OMUP) the learner's record are kept on file (folders) where the copies of birth certificate are kept.

Learners are assigned to classes by different people. At KMSS1, OMUP, learners are assigned to classes by the admission committee. At OMUC learners are assigned to classes by class teachers, this is because the school is small and there is only one class for each grade. At KMSP School, learners are assigned to classes by the section leaders for each grade group.

Class lists are kept on hard copies in schools which have school database such as OTJS, KMSS1, KMSS2 and KMSP.Class lists can also be viewed on the system and be printed from SchoolWrite software. OMUP and OMUC keep them on spreadsheet and print them from there.

Subject's syllabuses are kept on hard copies, where each HODs, keeps a copy and distributes to his/ her people in the department. Schools with internet connection download the syllabuses from National Institute Education Development (NIED) website and keep them electronically on their computers.

Health care information for the learners is kept on cumulative cards, and on the school database for those schools that use School Write software, except for OMUC. The cumulative cards are also used in the progression of the learner from one grade to another in all schools interviewed. The card is transferred to the next class teacher once a learner is promoted. SchoolWrite is used by KMSP, KMSS2 and by KMSS1 keep records of deleted learners as past learners.

4.3.3 Teacher's Record Management

At two schools OMUC and OMUP, teacher's records are kept in hard copies files, called personal files. These personal file contains a teacher's copies of qualifications, appointed letters, copies of leave forms, letter of completion of probation. These files are kept by the

principal in his office. In all schools when a teacher fills in a leave form, a copy is left with the school principal; another is taken to the school inspector's office and another to the regional office.

Copies of education policies, labour and personnel policies are kept on hard copies. Each HOD has one and make copies for his/her people.

4.3.4 Learner's Marks

Learner's marks are calculated using Continuous Assessment (CAS) mark sheets. CAS sheets are developed and obtained from NIED. So teachers on all government schools use these sheets to assess and to calculate the final marks for the learners. CAS mark sheets are different for each subject and for each level of school (e.g. lower primary, junior primary, etc.)

The principal gets the CAS sheets for each subject from the inspector's office and give them to the Head of departments (HODs) whereby the HODs distribute them to the teachers who are under them. At school where there is internet, the CAS sheet and syllabuses are also downloaded from NIED website.

Teachers use the CAS mark sheets to calculate the final marks of each learner. Once the final marks are calculated the marks are submitted to the secretaries, whereby the secretaries upload the marks in the system (SchoolWrite) so the marks can be printed out on the learner's report. OTJS School also uses a feature of SchoolWrite software whereby a teacher downloads a class to a USB, and then he or she can work on the final marks while at home or somewhere else. Then after teacher is done, he brings the USB stick to the secretary to upload it on the system (SchoolWrite).

The learner's final marks are kept by the teachers, HODs, a copy with the principal, and for the school that use SchoolWrite.

4.3.5 Learner's Attendance

All the schools follow the Ministry Education procedure of recording attendance. The schools do their attendance register once a day for each class and a summary is done every

Friday. At the end of each week, attendance is recorded in the summary book, which later,for school with SchoolWrite is uploaded on the system so they can be used on the learner report generation. The information of attendance is also used for the report of government statistics (such as EMIS, principal's report, etc.).

4.3.6 Classroom Naming
Each school gives classroom name as it is applicable to their school needand situation. For example OMUCSchool in the rural named their classroom as grades, because there is only one classroom for each grade.

4.3.7 School Events
Events at school are planned yearly or per term, for example the yearly plan of action for academic improvement, school development plan, school board meetings. Other events such as cultural events, Grade 12 farewell, and sport activities are also planned either yearly or per term. Teachers are notified about the events in staff meetings, learners are notified at general morning assembly. While rural areas schools notify parents about school events by letters or radios.

4.3.8 School Payments
Most of the schools use the secretaries to receive school payments, some school record in treasury books, some put records on computers or in invoice books. OTJIS School uses class teachers to receive payments from the learners and hand in the receipt books to secretary for proper records.

4.4 Overview of School software that are Used by the Interviewed Schools

From the questionnaire and the interview conducted it was found out that the schools use the following school administrative software: SchoolLink, aSC Timetable, and SchoolWrite. Below is the overview of the software.

4.4.1 SchoolLink

SchoolLink is a school software solution developed by Edupac, a South African company that was founded in November 1997(schoollink.co.za). The software is a web-based school management that can be deployed on almost any computer infrastructure. According to the schoolLink websiteschoollink.co.za, the software is the first web bases system designed specifically for African schools. It is able to operate on wide or local networks or standalone personal computers.

The software has the following modules (schoollink.co.za):

> *Software Administrative module:* This contains administration module, attendance register, discipline, staff module, academic progress, assessment and evaluation. All these can be customized to fit the need of the school (schoollink.co.za);

> *The Financial module:* contains the general ledger, budget, debtor's ledger, creditor's ledger, and stock and assets;

> *Software Add-on module:* which contains EMIS statistics (from school to district office, to regional and to head office), timetable, library/media, year planner, remote mark input, sms module (can send bulk sms to parents of outstanding balances);

> *Software Reporting:* SchoolLink contains about 400 predefined report templates with filter selections to create specified reports.

Schools subscribe to a low-cost annual support and upgrade agreement, which allow them to stay in contact with Edupac's helpdesk and enables them to utilize the latest software version available from Edupac's website (schoolLink.co.za).

The Namibian Ministry of Education in 2009 selected the Edupac as the sole and official provider to supply school management information solution (SchoolLink) to all schools in Namibia through an agreement which includes the licensing, intellectual property, customization, support and training of educational institution and particular schools. The

main aims and benefit of the agreement for Namibian education were highlighted as follow by Van Wyk (2010) article in the New Era newspaper:

- Transforming rural schools to be just as effective as urban schools;
- Collecting information from schools into a single central system;
- Provide just in time data to management for effective decision-making;
- Obtain a customised web-based school management software solution and timetabling programme for all selected Namibian schools and the NIED;
- Bridging the digital divide and better managed schools.

All the above benefits are in line with the Vision 2030 of improving the quality of life of people (vision 2030). According to Van Vyk in the article SchoolLink Education Management system is free for all schools (public and private) and other educational institutions. It is also reported that schools will also be supported by technically competent personnel at the NETSS throughout the implementation.

This project will provide the system that can be used by the school in the meantime while all the school will be provided with internet for the provision SchoolLink to all schools in Namibia, since the system will also be free.

Currently there is a challenge of many schools not having internet connectivity and it will be costly to provide all schools with internet connection. Another challenge is that most rural schools do not have electricity, but this could be done with the solar energy. Bandwidth is another issue that will affect the provision of SchoolLink to schools.

4.4.2 Schedules & Reports

Schedules & Report is an Excel Workbook, which is used by OMUC and OMUP schools. The tool was designed and developed by Andreas Richard from Switzerland between the years 2006-2009 who was working as a volunteer at a School called Ashipala Senior Secondary school in Omusati region. The read_me file of the workbook reported that the first version of the tool was designed by Loren Niemi, Florida, and U.S.A. The workbook is issued under the GNU general Public license.

The workbook is designed to work for some specification of Namibian education system. There are four templates designed for each type of school level (Lower Primary, Junior Primary, Upper Primary and Secondary School). The workbook template allows teachers to leave tedious calculations and writing reports to a computer, which can do these tasks faster and more reliably.

The template allows a user to enter school information, create reports, print reports and it uses grading scales which are specific to Namibian examination.

The workbook is not a proper information system or software; it was just designed to automate some of the school administration tasks. Below is the screen shot of one of the template!

Figure 4.3, Screen shot of Schedules & Reports Workbook

4.4.3 aSC Timetable

According to the Facebook site, the aSc Timetable application was founded in the year 1997 (http://www.facebook.com/pages/aSc-Timetables/27349727703). The application is used to create weekly (or multi-week) timetables and handle scheduling tasks.

The application is designed for all types of primary and secondary schools. It allows a user to enter basic data such as classes, teachers, classrooms, subjects, lessons (cards), school week, and start and stop times, etc. Time table constraints such as availability of resources (class, teacher, classroom, and subject), card relationships (evenly distribution, subject order, etc) can be defined. The application is used by the two schools OMUC and OMUP. Below is the screen shot of the aSCTimetable:

Figure 4.4 Screen Shot of aSC Timetable

4.4.4 SchoolWrite

According to SchoolWrite website (schoolwrite.com) the following section is an overview of SchoolWrite software.

SchoolWrite; is a school software developed by Brennan Bates & Associates, Australia. It is a multi-user computerized School Management system which is suitable for schools and

tertiary colleges. It is designed to integrate the control of all financial activities with a flexible academic administration system. SchoolWrite's Intranet provides browser-based access to student data from any work station on the school network. Home Class lists with photographs may be viewed and printed. Individual student details can be brought to the screen, including the student's timetable, exam results, and teacher comments.

SchoolWrite provides a versatile billing system and follow-up of overdue fees, resulting in improved cash flow. All of this information links with a school ledger.

Using family and academic records for billing as well as administration, ensures minimum data entry, and results in the use of up-to-date information in all areas of the school. The utilisation of this information by faculty as well as administrative staff enhances the professional presentation of the whole school.

A Timetable printing module, a future Enrolments module and a Past Students module provide a total management solution for schools, assisting staff to efficiently manage the day-to-day running of a school and plan for future requirements.

SchoolWrite consist of the following modules:

- Student records,
- Report Write - offline entry of end-of-term report marks & comments,
- Timetable printing,
- Parents Fees billing,
- Past students,
- Future enrolments,

As well as covering the necessary general accounting requirements of

- General Ledger,
- Accounts Payable
- And Payroll.

The modules are fully integrated. However the company has made it possible for one to purchase individual modules as per the school's requirements.

The website (schoolwrite.com) also report that the software is being used in the following countries; Australia, Malaysia, Namibia, South Africa, Uganda, Tanzania, USA, Nigeria, Botswana, Zambia, Ghana, Kenya and the Caribbean.

4.44.1 SchoolWrite in Namibia

According to the SchoolWrite Namibia site (schoolwrite.com/Namibia), SchoolWrite was in Namibia since 1997. Table shows the statistics of Schools in Namibia by regions that use SchoolWrite Software. The table also indicates the region that hastraining and support centers for SchoolWrite.

Table 4.4 Number of Schools with SchoolWrite Installation per Region in Namibia

Region	No. of schools usingSchoolWrite	Regional Training and Support Center
Caprivi	1	
Erongo	38	X
Hardap	9	
Karas	22	
Kavango	4	
Khomas	74	X
Kunene	13	
Ohangwena	16	
Omaheke	25	
Omusati	4	
Oshana	12	X
Otjikoto	18	
Otjozondjupa	29	x
Total	256	

Source: http://schoolwrite.com/namibia/index.html

The number of installation includes government and private schools. This was obtained from the comments on the website about the software, that some schools are private.

The table gives a total of 265 schools in Namibia with the installation of SchoolWrite software. Comparing with the number of schools in Namibia which is about 1672 (Education statistics EMIS report, 2008), the SchoolWrite software has covered 16% of the schools in Namibia.

There are also installations, training and support centers distributed in some regions for support of the software, as indicated in Table 4.4.

The resellers of SchoolWrite in Namibia have collaborated with the Ministry of Education to tailor made the reports for government schools. Some of the reports that were customised are: Junior Primary Report Card, Upper Primary Report Card, Secondary School report card, Promotion Schedule, Promotion Schedule Summary, 15th Day School Statistics, Student Statistics- Reason for leaving, Student statistics-Nationality & Language, Disciplinary Steps Report, Student ID labels (schoolwrite.com/Namibia).

From the questionnaire and the interview, it was indicated that school purchased SchoolWrite from school funds and each school chose their modules that they require and afford. The price of the SchoolWrite software is as follow according to the website (schoolwrite.com): for Academic Records module it costs US$ 149 per year and for School Fees and Accounting US$ 149 per year. Conversion to Namibia dollars amount to about N$ 1186.04 per module.

Registration by an end-user may be for the Academic Records component, and optionally for the Parents Fees and Accounting component. Registration may be for 12 months (renewable every year) or for an unrestricted licence (pay once-no more to pay)

4.4.5 Computer Literacy Level for Secretaries, Teachers and Principals and Computer Platform Used

Most of the school computers runs Microsoft platform with most of their software running above Microsoft operating system. The schools with computer donated by SchoolNet use Linux based operating system and software.

Namibia school teachers, principals and staff still have a challenge of computer literacy, despite the effort made by the government to train teachers, principals and secretaries on computer literacy. This is because once a teacher or school administrator is trained, and goes back he or she has nowhere to practice the skills acquired.

A number of initiatives have been done by the Ministry of Education to train the teachers and the school administrators. The following are some of the initiatives done by the Ministry:

- Regional Teachers resource centers are equipped with computer laboratories where teachers and principals can be trained (nied.edu.na);
- Tech!Na initiative: one of its goal is to educate school administrators, staff members, teachers and learners in ICT literacy and ICT integration across the entire curriculum (techna.na);
- The Ministry of Education has also signed an agreement with ICDL Africa to role out the ICDL (International Computer Driving License) certification programs for ICT literary to Namibian schools, where all teachers and students and school leavers can be trained and be certified. The ministry has committed to training and benchmarking the ICT skills of all teacher, students and pre-teachers through a network of Ministry approved ICDL centers. The quality assurance of the project implementation is provided by the ICDL Foundation of South Africa office in Cape Town (ICDL newsletter, 2006).

With these initiatives and with NGOs funding and donating computers at schools, it is expected that the computer literacy levels of teachers and school administrators will improve in the next few years.

4.5 Summary of the Findings

From the findings of the interviews and the questionnaire, the following strengths of computers use in administrations were found;

- That all government schools follow the government structure to administering their schools. This make it easy in the design and development of the computer assisted system that there is no need for specific customisations;
- At least most schools have a computer and mostly being used for administration of the school, so the computer assisted school information system can be installed in one of those computers;
- Secondary schools have more than 10 computers, maybe because they are on the first priority on provision of computers and ICT by the Ministry of Education and the IT initiatives of the Ministry;
- From the interview it was noted that school teachers, secretaries and principals see and understand the need of automation of school administration.

The following are the weaknesses noted from the data collection methods;
- Schools with one or few computers will not enable the teachers to fully use the computers and the administration software.
- Internet connection is another limitation of the provision of the school administration that can be accessed on the Internet. Internet is also expensive and some schools cannot afford to pay from their school funds.
- The cost of keeping the computer maintenance and school administration licenses is too high and still some schools cannot afford it.

4.6 Summary of Feasibility Study Report

The feasibility results show that the computer assisted school information system will contribute to the objective of the schools, where it will improve the efficiency of the administration of schools. From the interview data it is concluded that the system should include features that are common to Namibian government procedure. The following are

some of the features that should be included above normal school administrations features (learner's records, teacher's records, attendance, reports, etc.):

- CAS mark sheets to be built in, so the teachers will just put in marks then the system calculate automatic;
- Web-browser interface that teachers can even connect from their laptop, anytime, anywhere on the internet ;
- School documents, policies, syllabuses to be kept on the system and be able to be accessed by everyone anytime;
- Cumulative cards to be implemented on the system;
- Teachers to be able to print out their own class lists;
- Teachers to be able to upload attendance register themselves and the secretaries can just pull out summary reports;
- Recordings of school payments to be centralized, that it easy to pull out reports;
- Provision of stand-alone computer assisted information system for the schools without Internet and for schools with only one computer.

The system being developed is economic with respect to school's point of view; this is because the system will be maintained where it is hosted. It is cost effective in the sense that it has eliminated the paper work. The system is also time effective because the calculation of marks and reports are automated. Technical requirement is also economic since no extra hardware or software is needed since most of the schools have at least a computer and the system will use any web browser. The only needed item is the internet which the Ministry of Education to help schools to obtain and for the payment to be the responsibility of schools. An analysis done during the Educational conference about

The system will be quiet easy to use and learn due to its simple but attractive interface. Users will just need minimum training or guidance on how to use the system. One of the features that the 9system has is ability to upload data from spreadsheets into the system; this makes it easy for the users in uploading data in the system.

4.7 Analysis of the Some Existing Free School Administration Software

Two free school administration software TS School free school administrative software and School Management System by Headmastersoft.com were analysed just to see how they can help in the design of the Namibian system. SchoolWrite was also analysed by installing a demo version and test the functionalities.

TS School

TS School is a free school administration application developed by Time Software a South African company. It provides all schools with basic school administration software. It enables schools to add learners and staff, assign them to admin and subject classes, set up tests, enter marks and churn out report cards, produce class and individual staff and learner timetables, produce custom reports, documentation and letter of correspondent, enter general school information, enter staff and medical details. Below is the screenshot of the TS school software.

Figure 4.5 Screen Shot of TS School: School Management System

Figure 4.6, Screen Shot of TS School: School Management System

School Administration System V 1.02 by Headmastersoft.com

According to the help content of the School Administration software, SMS is a system for automating the student and class management in mid-sized schools. It is created especially for meeting the requirement of small and mid-size schools in student management, class management, teaching session management, student attendance management, reports and it can provide multiuser work over LAN. The software comes in two versions, the Standard Edition (the base configuration) and the Professional Edition (profession version with all features). The Standard edition is the one that was analysed in this research.

Figure 4.7 Screen Shot of School Administration System.

4.8 Conclusion

The data from the interview and the questionnaire shows that most schools have computers and they have somehow software for helping in administering the school. The interview also revealed that all government school follows the same procedure of administering the school that is designed by the Ministry of Education.

It was also found out that all the schools interviewed bought the software and maintain the computers from the school funds. Schools tried to obtain different types of school administration software, so that they can easy and faster their operations at schools. One conclusion that was made from the interviews is that some schools are not happy with the school administration they have purchased so they keep on changing (switching) between SchoolWrite and SchoolLink. This bring up the need to the government or Ministry of Education to help out school or find a way of helping schools in maintenance of computers.

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According to the Deputy Director of Information Technology at the Ministry of Education Johan van Wyk (as reported by Lorraine Kazondovi, 2011), it will cost Namibia N$ 1 billion to equip the 1700 schools across the country with computers. In addition, to connect every school in Namibia with internet, it will cost N$ 4 million per year. The amount was calculated based on the rate of about N$300 per month to have Telecom Namibia provide internet access to all schools. The provision of internet could be achieved with solar energy for schools in rural area that has no electricity. This poses a challenge for Namibia that is still far from achieving the vision of providing internet to all schools.

Namibian schools need school software that will provide the need of the schools in terms of administration. It is hoped that the Edupac-SchoolLink will have Namibian school after the completion of the project.

The next chapter provide the analysis and design of the proposed system to be developed.

Chapter 5

5. Analysis and Design

This chapter discusses the system analysed and the design of the Computer-Assisted Information System for Namibian government schools. It presents the functional and non-function requirements, the use cases, ERD and the design strategy of the system.

5.1 Introduction

System analysis and design are basic activities in software development. Traditionally, they are carried out by a separate group of practitioners, who gather the system requirements, analyse them and prepare the specifications documents to be handed to the development group. System analysis involved a detailed study of the current system, leading to specification of a new system. Software design is the heart of the system development or project and it is usually considered crucial for the success of a software system. It consists of developing a database and software model which will interact with the database for storing, modifying and retrieving data.

This chapter presents the system analysis and the design of the Computer-Assisted Information System for Namibian government schools. It presents the requirement analysis and specification of the system using use case, ERD diagram and the design strategy used in the implementation of the system.

5.2 System Analysis

System analysis is a process of collecting factual data, understanding the processes involved, identifying problems and recommending feasible suggestions for improving the system functioning. This involves studying the business process, gathering operational data, understanding the information flow, finding out bottlenecks and evolving solution for overcoming the weakness of the system so as to achieve the organisational goals. Eardley et al. (1995) describe the purpose of system analysis as to show what the problems are and

what has to be done about them. This section will present the requirement analysis and specification done for this project.

5.2.1 Requirement Analysis and Specification

A requirement analysis is the process that comes after data is gathered, structured analysis is then done on the data in order to arrive at models of the system to be developed. The process makes the stated and unstated requirement of the system to be developed clear, complete, and unambiguous and detailed enough (Blanchard & Fabrycky, 1990). The system requirement is then documented. The following sections describe the system overview, user characteristics, functional and non-functional requirements; use cases techniques were used for analysis and for specifications of functional requirement of the development of the Computer-Assisted School Information System.

5.2.1.1 System Overview

The Computer-Assisted School Information System for administering Namibian public schools will be accessed through the web browser. Each school will have its own database hosted either at the specific data centre or on the local server at the school or in a stand-alone computer at the school. The system will help the schools to keep records of learners and teachers, to keep learner's test and exam marks, and to keep official documents.

5.2.1.2 User Characteristics

The two main groups of users are general administrators (secretaries, clerk, and principals) and the teachers.

General Administrators (secretaries, clerk, principals, etc.)

These users will be able to create School information, create user logins, add learners, teachers, classes and subjects to the system and be able to generate reports. To be able to use the software to its full potential, the user will need to be computer literate with mouse, keyboard operation and with web browsers.

Teachers:

These users will also have a wide range of both age and computer user skills. Their goal in accessing the system will be to input grades, input attendance and viewing classes and learner's details.

5.2.1.3 Functional Requirement

Functional requirement is defined by (eogogics.com) as the required behaviour of the system to be built, as reported by the hypothetical observer envisioning the inputs that the future system will accept and the outputs produced in response to those inputs.

Functional requirement can also be defined as requirement that specifies a function that a system must be capable of performing. These are software requirements that define the behaviour of the system, that is the fundamental process or transformation that software and hardware components of the system perform on inputs to produce outputs.

The following functional requirements will be implemented before the Computer-Assisted Information System for Namibia is deemed satisfactorily completed.

Login

Each user of the system should have a username and a password that will enable her/ him to access the system. The username will also be given specific access to modify data in the system. Different users have different access to the system, for example only the School administrator or principal can add/ edit learners and teacher's biography details.

Create School

The first time login will be from the administrator, where she/he creates the school details like the School name, School type (primary or secondary), departments, and subjects that the school offers. School semester will also be created where the start date and the end data will be specified.

Learner's demography

An administrator can add a learner's biographical details, during enrolment. she or he can also edit it later or display the learner's details. A teacher can also display the learner's details.

Teachers and staff members' demography

An administrator can add a teacher's biographical details, during enrolment. She or he can also edit it later or display the teacher's details.

Classrooms

An administrator can add a classroom details. She or he can also edit it later or display the classroom details. Teachers can also display class details.

Subjects

An administrator can add subjects to the system. She or he can also edit subjects and later can display the details.

Department

An administrator can add a school department; he can select it from the list of departments from the system or create a new one. He or she can also edit department later or display the details.

Learner marks

A teacher can add or edit or display learner's marks on the system. An administrator can view the marks.

Learner's attendance

Administrator and teacher can add the attendance register to the system and be able to view it.

Event

An administrator can add planned School Events. He or she can also edit Events and later can display the details; events can be displayed on the calendar.

School fees payment Records

An administrator can add, view and update the status of learner's school fees payments.

Store information or school official document

An administrator and teachers can upload and download school official documents.

Allocate a teacher to a class

An administrator can allocate teacher to class.

Allocate a learner to a class and grade

Administrators or teacher can allocate learners to class.

5.2.1.3.1 Use Cases

A use case is a methodology used in system analysis to identify, clarify, and organise system requirements (searchsoftwarequality.techtarget.com). It is a description of steps or actions between a user (actor) and a software system which leads the user toward something useful (Bittner & Spence, 2003). The user or actor might be a person or something more abstract, such as an external software system or manual process. It helps the developers to determine which features to implement and how to resolve errors gracefully (Adolph, Steve et al. 2002).

The Computer-Assisted Information System has the following features as shown by the use case on figure 5.1 below.
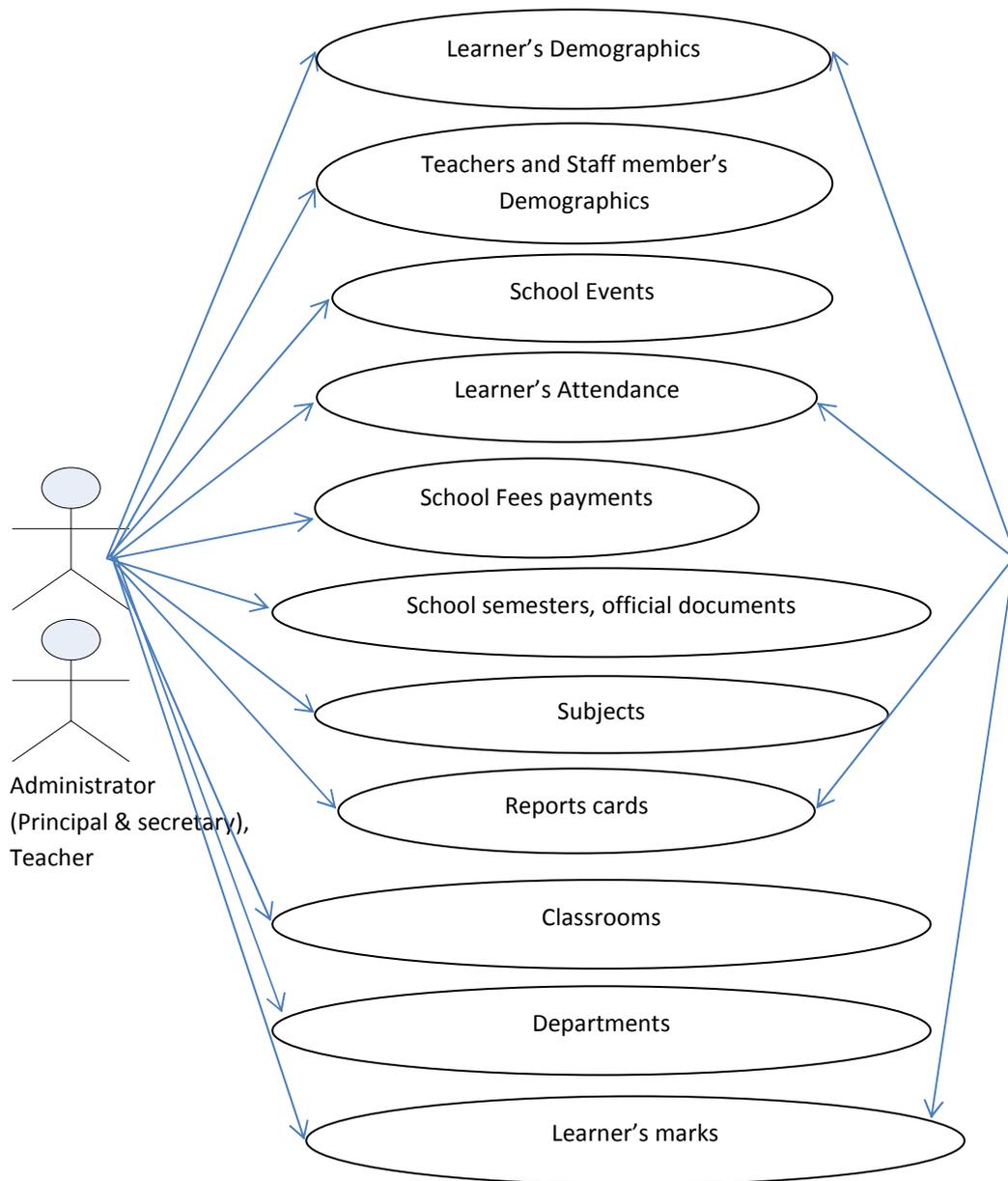

Figure 5.1 Use case for Computer-Assisted School Information System

1. Learner's demographics

   The administrators and teachers will store learners and family information that can be viewed, implemented and be printed. The learner's demographics contain all the information from the learner's cumulative record cards. The administrators and teachers will have their user interface to keep records of learner's demographics. When they enter into the system they will be provided the interface with the option to ADD, CANCEL or Edit. When they add the demographics in the system, the system will notify the user that the action is processed successfully or the action is cancelled or it will give an error. After the document or action is added, the system will display the recorded data as student demographics / details.

2. Teachers and staff members demographics

   The administrators will store teacher's information, qualifications, and experience and contact details. The administrators will have a user interface to keep records of teacher's demographics. When they enter into the system the system will provide the interface with the option to ADD, CANCEL or Edit. When they add the demographic in the system, the system will notify the user that the action is processed successfully, cancelled or the system will give an error message of why the action failed. After the document is added, the system will display the recorded data as student demographics/ details.

3. School Events

   Administrators can Add, Edit and Delete planned school events on the school calendar.

4. Learner's attendance

   Attendance can be entered by the school administrators or by the teacher. Attendance is done once a day by the teacher. Attendance reports are integrated with report cards/progress reports. Variety of attendance reports are available for the teachers or principals to allow it to integrate with normal school practice.

Administrators and teachers can add, edit, delete and view learner's attendance status.

5. School Fees payments

Administrators can add, edit, delete, print and view learner's school fees payments.

6. School semesters and official documents

Administrators can create school semesters and upload and download school official documents.

7. Subjects

Administrator can add, edit or delete subjects to the system, although the system has some default subjects that can be selected and be assigned to learners.

8. Report cards

This is a flexible reporting system per subject, objective, integrated attendance reporting etc. All report cards are printed as PDF reports and may include a school log. The report card will be generating as per subject, class, etc.

9. Classrooms

Administrators can add, delete or edit the classrooms, assigned learners and teachers to classrooms.

10. Departments

Administrator can add school departments, edit and delete them.

11. Learner's marks

Here the interface allows the teachers to enter marks and assessment online from school. It can group, weight assessment items and post directly into the report card system. The teacher will assign the assignment and enter the marks in the system.

The system will give the option of assign and cancel. After the teacher has finished assign the system will notify that marks are assigned.

5.2.1.3 Non-functional Requirement

Non-function requirement is described by Kotonya & Sommerville (1998) that they define the overall qualities or attributes of the resulting system, that they place restrictions on the product / system being developed, the development process and specify external constraints that the product must meet. Examples of non-functional requirement include safety, security, usability, reliability and performance requirements.

A non-functional requirement can also be defined as the requirement that describes not what the system will do but how the software will do it, for example system performance requirements, system external interface requirement, system design constraints and system quality attributes. Non-functional requirements are difficult to test; therefore they are usually evaluated subjectively (Chung, et al., 2000).

The non-functional requirement for the development of the Computer-Assisted School Information System for Namibian government schools is identified as follows:

5.2.1.4.1 Interface Requirement
Server side

The system will be hosted at one of the specific data centre (it can be the Ministry of Education datacentre or building or by a company providing cloud services) where the application server is running. The application can run on either Linux or Windows operating system. The system can also be installed in a local server and be accessed through the local area network of the school.

Client side

The system is a web based application, so schools are required to use modern web browsers such as Mozilla Firefox, or Internet Explorer. Computers must have Internet connection in order to be able to access the system. Due to the challenge of Internet connectivity, a stand-

alone system can also be installed on schools with one computer or without Internet connection.

5.2.1.4.2 Performance Requirement

The amount of storage space and transaction speed will need to keep up with the number of users the system acquires. Performance will also depend on the speed of the Internet the school has connected to.

5.2.1.4.3 Security Requirement

The system is to provide a login feature which will be password activated. Users will be allocated a username and a password that will allow them to access the system. Users will be put into groups which have certain permission to do change on the system.

5.2.1.4.4 User Documentation

The following document should be provided at the end of the development:

- A readme file to help the user with how to connect to the software;
- User Manual;
- Administration Manual.

5.3 System Design

System design involves generating, developing and analysing possible course of action, and provides details specifications for a system components, structure, and their features (Turban, 1995). It also involves the identification of entities, relationships and their data attributes (Eardley et al, 1995). According to Laundon and Laundon (1993), the design should show how the technical, organisational and people components of the system fit together. This section describes the design of the Computer-Assisted School Information System for Namibian government schools.

5.3.1 Software Used to Develop the System

An Oracle Application Express 3.2 (apex.oracle.com) was analysed to see if it fits to develop the school system. Oracle Application Express is a rapid web application development tool for the Oracle database. It uses a web browser and can develop and deploy professional applications that are both fast and secure. It is fully supported by Oracle and it is free (no cost option for the Oracle database). Oracle Application Express 4.1 is fully supported through Oracle Support Services on all Editions of the Oracle database, 10.2.0.3 or higher with a valid Oracle Database Technical Support agreement while Application Express 4.1 is supported through the Oracle Technology Network (OTN) discussion forum and not through Oracle Support Services (apex.oracle.com).

Oracle APEX has the following features which makes it feasible to be used to develop the system for the schools:

Data Upload from spread sheets: It allows developer to create pages where an end user can upload a file or cut and paste data into a table.

Charting and Maps: It enables the developers to provide better graphics and decreases rendering time. It enables the developers to customised appearance of charts in good graphics.

Interactive reports: can enable the developers to produce reports that allow end users to manipulate the data as they need.

Calendars: enable developers to include the ability to create and edit calendars, which can include drag and drop functionality allowing end user to change the date and or time of a record by dragging it on the calendar itself.

Plug-ins: enables developers to create highly customised components to enhance the functionality, appearance and user friendliness of their applications.

Data Upload from spread sheets: The developer can utilise a wizard to create a collection of pages that allow the end user to upload a file or cut and paste data into a table. Additionally the developer can define lookup columns and data transformations.

Interactive Reports: Interactive Reports take much of the burden off developers to produce all the different online reports end-users want by allowing end-users to manipulate the data provided for them.

All the above features were found to be suitable to be used in the development of the school system, so Oracle Express 4.1 was used in the development of the system.

5.3.2 Architectural Design

Architectural design is the process of defining a collection of hardware and software components and their interfaces to establish the framework for development of a computer system. Figure 5.2 shows the architectural design of the Computer-Assisted Information System for schools. The software can be hosted on a specific data centre where the schools connect to the system via Internet. The system can also be installed on the intranet (locally) at the school where users can connect to it locally via the web browser. The system can also be installed on stand-alone computers. This makes the provision of the system to schools without Internet and/ or without enough computer infrastructures. Figure 5.2 shows the architecture of the system.

Figure 5.2 Architectural design of computer assisted school Information system.

5.3.3 Database Design

5.3.3.1 Tables

The database for the system was designed to have the following tables: School, learner, subject, semester, staff members, teachers, official documents, events, departments, attendance, payments, subject enrolment, class, report cards, learner's marks, and teaching subjects. Four other tables were created but not included in the ERD diagram; they are School attended general, school attended specifics, physical conditions, psychometric/learning disabilities and problems, general information for learners. These

four tables are included to be able to show the cumulative record card of learner fully on the learner's biographic details.

The subjects are by default in the database which is subjects that are offered in all types of Namibian government schools and it is possible to edit or add new subjects. The data dictionary of the database can be found in Appendix Y for more details.

Entity-Relationship Diagram (ERD)

An entity-relationship diagram is defined by (searchcrm.techtarget.com) as a data modelling technique that creates a graphical representation of the entities, and the relationships between entities, within an information system. An entity-relationship diagram can also be defined as a graphical representation of entities and their relationship to each other, used in computing in regards to the organisation of data within databases or information systems. An entity is a piece of data or concept about which data is stored. A relationship is how the date is shared between entities.

An ERD during system analysis phase gives the analyst a clear and high-level view of the data, so it is the excellent starting point for modelling the system. It is also used to understand organisation data needs, in the planning and designing a database.

An ERD for this project was drawn, based on the analysis of the data collected from Interviews, questionnaire, analysis of the EMIS report. Figure 5.3 below is the ERD of the system. Sixteen entities were identified for the system; the entities are School, semester, events, official documents, staff members, teachers, department, subjects, teaching subjects, learner marks, learner, subject enrolment, attendance, class, report cards, and payments.

Figure 5.3 ERD diagram for the Computer-Assisted School Information System for Namibia

5.3.3.2 Forms

Forms in databases are data entry screens; they are the interface users utilise to work with data in the database. They often contain buttons that perform various commands. Forms allow the system to control how other users interact with the data in the database. For example one can create a form that shows only certain fields and allow only certain operations to be performed. This helps to protect and to ensure that the data is entered properly.

Six main forms are designed for the development of the Computer-Assisted School Information Systems which are:

- Learner form - which is used when entering the biological details of the learner;
- Teacher form – for entering the new teachers biological details;
- Subject form –for entering the new subjects;
- Marks – for entering learner's mark;
- Staff member form –for entering new staff member's details;
- Department form –for entering new the department details;

5.3.3.3 Views

The website (tdan.com) defines a database view as a database object that looks and functions exactly like a table, except that it can contain data from multiple database tables. Database views allow system to easily reduce the complexity of the end user experience and limit their ability to access data contained in database tables by limiting the data presented to the end user. Views are usually used for the following reasons (tdan.com):

- To provide simple, granular security – a view can be used to limit the data that a user is allowed to see in a table;
- To simplify the user experience – a view can hide complex details of the database tables from end users who do not need to see them.

The following views are created for the Computer-Assisted School Information System:

- Class list – listing of a specific class learner's names that can be printed and be used as hard copy;
- Class marks – marks of the learner is a specific class for a specific subjects or multiple subjects;
- Class attendance – attendance report or view of the class;
- Class payment – the view of a specific class payment status of the learners.

5.3.3.4 Reports

Reports are used to quickly analyse the data or to present the data a certain way in print or in other formats (office.microsoft.com). Reports summarise and present data in the tables. They usually answers specific questions, such as "How much money did we receive from each customer this year?" Each report can be formatted to present the information in the most readable way possible. A report can be run at any time, and will always reflect the current data in the database.

The following reports are designed for the Computer-Assisted School Information System:

Report card generation;

- Learner's registration information;
- Report that answers the EMIS questionnaire;
- School Fees payment report.

5.3.4 Interface Design

A user interface is the part of the computer system with which the user interacts with, in order to use the system and achieve his or her goal (elsevierdirect.com). A good user interface design is needed to encourage an easy, natural and engaging interaction between a user and a system and it allows users to carry out their required tasks.

For this system the user interface will allow the user to easily generate data, documents, search for documents, and modify documents. The user should be presented with all main functions on the first user interface page to allow for the user to select the function to use without the need to navigate inward to find it. The interface will be accessible through the web browser to allow for centralised hosting and use by various operating systems.

Followings are the structure of the user interface design of the Computer-Assisted School Information System:

The interface design is divided into five groups, the Administration group, Learner information, teacher and staff details, learner's marks data, and the reports.

Administrator interface

The administrator interface can only be accessed by the school administrators which are the principals, secretaries and sometimes head of departments. One can create the school information, upload and download official documents, create user logins, create departments, add new subjects to the system, create class and add the events to the calendar.

Learner's Information interface

The learner's information interface can be access by the administrators with full access and the teachers with view access. The interface enables the administrators to add, display each learner's details, enrol learners with subjects, assign learners to classes, and update learner's school fees.

Teacher and staff member interface

The teachers and staff member's details are managed on this interface. The addition, the modification and the deletion is done by the system administrator. Searches on the teachers and staff member details can be done here and teachers can be assigned to subject on this interface.

Learner's marks

This provides an interface for the teachers to add, modify, delete and calculate the learners' examination marks. CAS mark sheets, mark lists, and attendance entry can be done on this interface by the teachers.

Reports Interface

At this interface is where the reports are being generated. Learner's report card generation can be done at this interface and be printed or save on local machine. Other reports such as learner's registration information, the report that answer the Ministry of Education EMIS questionnaire and a learner's school fees report.

5.4 Conclusion

This chapter discussed the process, the analysis and the design of the database and the interface of the system. It uses the use case and the ERD diagram in the analyses of the system requirement and in the designing of the system.

The interface design is done in a way to provide menu driven interface, the user can interact with the site quite easily. It is designed to be used on the web browser so it saves a lot of space and time.

The next chapter presents the implementation of the design discussed in this chapter.

Chapter 6

6. System Implementation

This chapter discusses the implementation of the computer assisted school information system for Namibia government schools as it was mentioned in chapter 5. It also provides the evaluation of the developed system.

6.1   Introduction

System implementation is the carrying out or execution of the system design. It encompasses all the processes of constructing the system, installation, configuration, running and testing the system and making necessary changes to improve the system.

This chapter discusses the architecture of Oracle APEX database connection and the construction of some of the functionalities of the computer assisted system as it was mention in Chapter 5 of the system design. Testing and evaluation that was done on the system developed is also presented in this chapter.

6.2 Database Connection

This section describes the architecture of Oracle Apex, it explains how the Oracle
Application express connects with the Oracle database to provide the service to queries and transactions.

Oracle Application Express Architecture
Oracle Application Express consists of a metadata repository that stores the definitions of applications and an engine (called the Application Express engine) that renders and processes pages. It lives completely within the Oracle database. It is comprised of nothing more than data in tables and large amounts of PL/SQL code. The essence of Oracle

Application Express is approximately 425 tables and 230 PL/SQL packages containing 425,000+ lines of code (oracle.com).

Figure 6.1: Architecture of Oracle Application Express

Source: http://www.oracle.com/technetwork/developer-tools/apex/apex-arch-086399.html

The Application Express engine performs:

- Session state management
- Authentication services
- Authorization services
- Page flow control
- Validations processing
- Rendering and page processing

The asynchronous session state management architecture ensures the minimal CPU resources are consumed. The browser sends a URL request that is translated into the appropriate Oracle Application Express PL/SQL call. After the database processes the PL/SQL, the results are relayed back to the browser as HTML. This cycle happens each time one either requests or submits a page. The session state is managed in the database and

does not use a dedicated database connection. Each page view results in a new database session, thus database resources are only consumed when the Application Express engine processes or renders a page (oracle.com).

The Application Express engine is accessed from a Web browser through a Web server. Applications are rendered in real time from the metadata repository stored in database tables. Building or extending applications does not cause code to be generated; instead metadata is created or modified (oracle.com).

6.3 Functionalities Constructed

6.3.1 Learner's Biographic Functions

Three pages were created for the maintaining learners (Addition and editing learner's biographies), for viewing learner's biographies and cumulative card records. A cumulative record card that is being used in Namibian government school is translated to a database tables and records and can be displayed and edited for each learner.

List of Values (LOV) were created to be used in all the form's radio groups and select lists. Below is the list of LOV that were created and used in application.

- Nationalities list of some nationalities, e.g. Namibian, South African, Angolan, a user can select from the listed or select others.
- Home Languages – Most of Namibian home languages e.g. English, Oshindonga, Otjiherero, etc
- Cities/towns - Most of the cities and towns in Namibia can be selected
- Grades – option to select from grade 1 to grade 12
- Send correspondence to –send correspondence to mother, father, guardian or both. This LOV is also used in learner lives with.
- Religion- some of the religions where a user can choose from, such as Christianity, Islam, etc.
- Gender –male or female

- School Levels – Namibian school levels are in four groups which are Lower Primary with a range of Grade 1-4, Upper Primary Grade 5 -7, Junior Secondary Grade 8 – 10, Senior Secondary Grade 11- 12.

- Grade level (Grade level are as per school level, grade 1-4, grade 5-7, grade 8-10 and Grade 11 -13

- Subject level – Subject level is mainly for grade 11 and 12, where subjects are taught either core, or extended, ordinary level or higher level.

- Language subjects – this is to check if the subject is a language subject or not so it can be assigned a level. The two list are (that the subject is a language) yes and no (not a subject language)

- Language levels- whether the subject is taken at first language or second language level or third language.

- Department – is a dynamic query based list of value which pulls out all the department names from the department table. The query of the LOV is below:

```
select dept_name d, department_id r
        from   departments
order by 1
```

The learner's form as shown below on Figure 6.1 uses some of the List of value described above to make it easy for the user in selecting items when filling in the form. Once a user finish filling the form, he or she can click on the Create button then the data is inserted on the database table and a user is returned to a display learner's page. A user can also press the Cancel button and be put back to learner's display page.

Figure: 6.2: Learner's Biographic Form

Learner's display page is shown below on figure 6.3. A user can click on the Edit button to edit a specific learner details.

Figure 6.3 Learner's Display or Edit Page

Learner's cumulative record card can also be modified or viewed. Figure 6.4 shows the display of a learner after being searched and selected, then a display of figure 6.4 is shown. A user can click on any button to display the data on a specific item. For example to view the school attended (history of the learner's schools where he attended before he comes to the current school).

Figure 6.4 Learner's Details and Cumulative Card Records

6.3.2 Teachers and Staff member's Biographies and Information

Three pages have been developed to manage teacher's biographies and teachers subjects (subjects that a teacher is teaching at a school). A teacher's form, a display of teacher page, assigning of subjects to teachers and viewing subjects assigned to teachers. Figure 6.4 shows the teacher's form. A user after filling the form can click on Create button to submit the data to the table. A user can also press Cancel to cancel the submit action and the system will return to the teacher display page as shown on figure 6.5. On figure 6.5 a user can click on the Edit icon next to the name of the teacher to modify the biography of the teacher. The edit icon takes the user to the Edit teacher page.

Figure 6.5, Teacher's Biography Form.

Figure 6.6, Screenshot of a teacher subject display page.

6.3.3 Subjects

The subject's functionalities have four pages, one page for addition and editing of subjects to the system, one for display or view where a user can select the level of school of which the subjects he or she want to view. Most of the school subjects offered at different school levels in Namibia are in the system by default. The users have the option to add more subjects. Figures 6.7 and 6.8 below show the two pages of addition and maintaining of subjects. If a user press Create button, a record is added to the database, if user press Cancel button a user is taken back to the Maintaining page where the list of all subjects are listed.

Figure 6.7, Screenshot for Adding or Editing Subject Page

Figure 6.8, Subject Maintenance Page.

A user can click on the Edit icon and will be able to edit the subject.

Another page for subject functionality is subject enrolment for the learners. A page contains the form for enrolling learners with subjects, where a user select multiple subjects that will be added to the subject enrol table.

Figure 6.9, Learner Subject Enrolment Page

Subjects can also be viewed in categories of school levels, which are lower primary subjects, upper primary, junior secondary and senior secondary subjects. The Figure 6.10 below shows the page.

6.3.4 School Fees Payment

A form page for recording learner's school payment was also developed. An administration can add records of learner's school fees payments. The records can be viewed by selecting all the records or by searching a record for a specific learner. Figure 6.10 show the screen shot of the school fee payment record form.

Figure 6.10 Learner School Fees Payment Form

6.3.5 Learner's Attendance Record

There is a page for learner's attendance record, where only the absent status will be recorded on the system. Figure 6.11 shows the form for recording learners absent attendance form. Attendance can also be viewed for each learner under the learner page as seen in figure 6.4 by clicking on the Attendance button.

Figure 6.11 Add or Edit Attendance Page

6.3.6 Learner's Marks

Figure 6.12 shows the screen print of the Learner's mark form page where the uploading of learner's marks on the system can be done. The marks of each learner can be also viewed as individual in all subjects registered or per class or grade.

Figure 6.12, Page of the Form for Adding Learner's Marks

6.3.7 School Events Functionality

An administrator can create or add events scheduled for the term or for the year on the system. The form for adding events is shown on figure 6.13 below.

A page was also developed to show the calendar item, displaying the events for scheduled or planned for the school. A user can select the term and the events scheduled of the term will be displayed on the calendar. See the figure 6.13 below.

Figure 6.13, A Screenshot for a School Events Calendar Item.

6.4 Other Functionalities

6.4.1 Validations

Validation in Oracle APEX checks and validates the quality, accuracy, and consistency of the page submitted data prior to saving it into the database. In case of a validation error the system can alert the user and allow them to correct problems before data is saved to the database. Validation of pages forms is created for data such cell phone number, ID numbers, age, currency, etc. to ensure the correctness of the data being saved on the system.

6.4.2 Sorting, Filtering and Search

These functionalities were also developed for some report pages, for example searching for a learner, teacher or a specific subject. Sorting is also enabled for some table column as they are being displayed, a user have the option to choose which column to sort.

6.4.3 Downloading of Report Data to Spread Sheet

Some reports are also enabled to upload the data to a spread sheet where proper analysis can be done. This is one of a pre-configured feature of Oracle Apex.

6.5 System Evaluation

The previous chapter defined and described the system functional and non-functional requirements essential for the computer assisted information system. This section discusses the evaluation of the system to see whether it was designed and developed to meet the system requirement specified. The main reason for the evaluation is to verify how well the system fulfils the intended objectives. This evaluation was done by the system developer only and no evaluation was done by the users. This was due to the strict school calendar and my academic research timeline which was short.

The following criteria were used in the evaluation done by the developer.

Functionality:

The functionality criteria evaluate how well the developed system meets the pre-defined functional requirements mentioned in the chapter 5 of system analysis and design. Each functional requirement was evaluated and checked if the developed system can meet the requirement and if it can do the functions very well. The entire system was also evaluated if it can function efficiently as a single unit and give sensible outputs.

For example links and buttons were tested if they redirect users to the correct pages and that the data are really being inserted in the correct tables.

Performance criteria:

This criterion determines how the system performs in terms of responsiveness, accuracy of data and of algorithms accuracy. Measure of accuracy of data was done

in all the forms were the fields were validated whether the correct data types are inserted, and also checking whether the error messages for wrong inputs are fired whenever an error is occur.

Accuracy of queries and data insert and update was also evaluated where field length, correct calculations of transactions was done on some pages.

Installation Ease

The system was evaluated if it was easy to install, so it was installed on another personal computer to see how long it took to finish the installation.

Adaptability

Adaptability of the system was also evaluated because of different work zones of different types and configuration. So the system should be adaptable to different changing conditions. The system was evaluated on different Internet browsers. The browsers that were evaluated are Internet explorer, Firefox, and Opera.

The results of the evaluation was corrected on the system and then tested again in order to improve the quality and the effectiveness of the system.

6.6 Conclusion

This chapter has presented the construction and implementation of the system requirements mentioned in chapter 5. The functionalities implemented are such as learners, teachers, subjects, attendance, events, official documents upload and downloads etc. The chapter also presented the criteria used in the evaluation of the system, which was done by the developer. The evaluation focused mostly on usability and adaptability of the system. The results of the evaluation were corrected to improve the quality of the system.

Chapter 7

7. Conclusion and Recommendation

This chapter summarises the main ideas for the research, from the methodology used to collect data, the findings, and to the development of the SIMS system. It also gives a conclusion to the research. Furthermore the chapter provides the recommendations regarding the implementation of SIMS in Namibian government schools, based on the findings that were drawn from the research, and also suggests future researches that can be done to contribute to the knowledge of ICT impact on education institutions in Namibia.

7.1 Introduction

The use of school information management system has numerous advantages to schools, but careful selection and implementation of the SIMS is key. The SIMS to be used in a specific education system needs to be developed or customised in an approach supporting its implementation and the mind-set of its users as it does the technical attributes of the system itself. The SIMS should also be able to achieve the needs of a specific education system.

The purpose of this study was to develop a Computer-Assisted School Information System which is unique to Namibian government schools and which is able to assist schools in automating many tasks undertaken by the teachers and administrative staffs at school level.

Therefore this chapter summarises the study and the development of the Namibian government schools system. It also provides a few recommendations to the Namibia situation of the SIMS - Edupac –SchoolLink Project that the Ministry of Education is implementing, and suggests further research issues to be conducted.

7.2 Summaries

7.2.1 Summary of Methodology
.

The main questions of this applied research were:

- Is it feasible to automate school administrations specific to Namibian government primary and secondary schools?
- Is it possible to provide Namibian government schools with cheaper, user friendly SIMS that fit to their needs?

- How such system should be build, managed and used during admission procedures, storing of officials and student records, record attendance, record grades in examinations, and reports on students performances?

We collected data for analysing user's requirement by interviewing and filling in questionnaires in six (6) primary and secondary government schools. Two schools were from rural area and the rest from urban area. Three criteria were used in selecting schools which were schools with the reputation of following government procedures, schools with computers being used full time and schools with a pass rate of 35% of grade 10 and grade 12 for secondary school. This field intervention lasted about six months..

Data collected were structured and summarised in the following categories: learner's record management, teachers record management, learners marks management, learners attendance management, classrooms naming and allocations, events planning and notifications, management of school fees payment. The questionnaire data was structured according to general information about schools, number of computers and internet connection in schools, computer usage and administrative software used in schools. The data was then analysed by reading through the interview notes to gain familiarity and by analysing the questionnaire answers, establishing patterns and creating categories. The analysed data was then summarised according to categories and then generalised.

7.2.2 Summary of Findings

The findings of the data collections reveal that most schools have at least a computer.. It also shows that those computers are also used in the administration of the schools and that some even have school administration software installed. Software such as SchoolWrite and SchoolLink are found in some schools.

Only a few schools were found with Internet connections, even some urban area schools don't have Internet connection. The principals, teachers and secretaries see and understand the need for automating school administrations. That is why a lot of teachers are taking advantage of the ICT initiatives that the government is providing to train teachers and principals in computer literacy.

Although the Ministry of Education has currently an agreement with EDUPac, a South African company, to supply a School Management Information solution (called SchoolLink) to all government schools in Namibia whose software is already installed in some selected schools for the pilot project, it was found from the interview that some schools indicated that they are not happy with the SchoolLink and they keep on changing between SchoolWrite and SchoolLink.

7.2.3 Summary of the Development of the System

The requirements to address the three main questions of the research were analysed and a system designed and developed using software called Oracle 10g Application Express (APEX), a rapid web application development tool for the Oracle database. It uses a web browser and can develop and deploy professional applications that are both fast and secure. Oracle APEX was installed on a Microsoft Windows computer where the system was developed. The developed system is a web-based system which can run from a local area network or even from the Internet. The system is specific to Namibian education system in such a way that it has the default subjects that are being taught in Namibian schools. The system is capable of keeping electronic copies of official documents, such as syllabuses, education policies, Namibian specific CAS mark sheet as created by NIED, etc. It has also incorporated the cumulative record card that is currently being used in schools and being transferred between schools.

7.3 Limitation

This study is a research project, in partial fulfilment of a Master's degree in Information Technology at the Polytechnic of Namibia. The size of the population was very small due to limited time and money for travelling to other regions. Usability evaluation of the proposed system could not be done due to difficulty to manage the strict school year calendar and this academic research time schedule. The system did not include the development or provision of Timetable and finance module for the schools.

During the research I have encountered the following constrains and obstacles:

First it was difficult to make appointments with school principals because most of the time they were busy. It was also difficult to come together for a focus group discussion because of the distances and the scheduling time of the focus group members. So I use telephone discussion with some individual members and for those who I could reach we met face to face. This slowed down the process of data collection and delayed the research so much.

Another constrain was to get hold of somebody from the Ministry of Education to interview about the SchoolLink Project. The information discussed on the report about SchoolLink was obtained from the internet documents, newspaper reports and some from the discussion from the focus group members.

7.4 Recommendations

Based on the findings and considerations made from this study we suggest the following recommendations:

- Ensuring a sustainable computer infrastructure and funding.

  The Ministry of Education should establish partnerships with civil society, NGOs, private organisations and international communities to contribute to the provision and funding of computers and computer infrastructures for schools. This is to speed up the implementation of the School administration software (SchoolLink) and to develop the Namibian ICT economy and to reduce the burden on tax payers.

- Maintenance and support of ICT infrastructures at school.

  The findings from the research shows that school maintain their computers from their school funds and no government support on this. It is recommended that the government should somehow be involved in helping schools to maintain their computers. For example the Ministry of Education can take necessary steps to encourage other sources of funding and involvement in the maintenance of school computers and infrastructure. This can include industry sponsorship, local fund-raising initiatives, community activities, etc.

- ICT literacy for principals, and teachers.

  ICT literary for principals and teachers is still a challenge in Namibian schools, despite the many initiatives the Ministry of Education has done. Principals should be able to be confidence in using computers and be able to understand what the various management and administrative ICT system can do. More emphasis is needed on ICT literacy for teachers and principals, to ensure that the challenge is overcome and for the proper and efficiency use of School Information Management systems.

- ICT Visions and Technology Plan for schools.

  School principals should initiate development of ICT visions and technology plan for schools that will direct where the school is going. They should also promote ICT usage in schools by adopting strategies that make ICT a daily task for teachers. This will encourage the teacher in the use of the School Information Management systems.

- The Ministry of Education should appoint advisory committee at regional office level to oversee training and advice teachers and principals on ICT matters of schools. This advisory committee should at least comprise of the member of the ICT in Education Steering Committee at the regional level.

- SchoolLink software that is being developed for Namibian schools should include the features for sharing cumulative record cards between schools whenever learners are transferring to different schools.
- SchoolLink should also make provision for parent involvement or having access to their children school information over the Internet and or receive notification and report via mobile short messages service (SMS).

7.5 Future Work

More research work needs to be done on the ICT usage and school information management system in Namibian schools. This study was limited to six (6) schools so this study needs to be expanded to a wider population using mixed methodology approach. Such studies could be limited to one level (Primary, combined or senior secondary schools) or it could involve a combination of all levels and analyse for any significance differences.

Other research could be to assess ICT readiness of teachers, principals and school administration staff to see how and whether they are prepared for School Information Management system such as SchoolLink.

A more Technical analysis of computer infrastructures need in schools and whether schools are ready for SchoolLink implementation and usage is another possible applied research to be undertaken.

Finally a continuous usability and sustainability review of ICT in Namibian schools can be researched, focussing on appropriate and effective use of technology for education..

7.6 Conclusion

Information Technology is advancing very rapidly and it is entering in all the industries to make work smoother, accurate and faster. The Education industry has also benefited from the ICT technology in school management information systems. Various companies had offered different types of school management software that depend upon the nature and requirement of a particular school system.

This project provides a system that can be used by the schools in the meantime while waiting for the provision of the government-based SchoolLink to all schools in Namibia, since the system will also be free. This will keep Namibian schools abreast on technology while the challenge of Internet connectivity of school is solved. It is also expected that Internet connection will become cheaper and more bandwidth to be available soon with an optical fibre cable called West Africa Cable System (WACS) on the coast of Swakopmund that is placed by Telecom Namibia. The WACS cable presents Namibia and indeed West Africa with an opportunity to significantly cut telecommunications costs, bridge the digital divide, promote self-sufficiency in terms of bandwidth provision, and build a successful ICT industry (namibiansun.com).

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Appendix A

1. Interview Questions

School Interview Questionnaire

Introduction

This questionnaire is part of the research project titled: "***Development of a Computer-Assisted School Information System for Administering Namibian Schools***" for a Master Thesis at the Polytechnic of Namibia. The aim of this questionnaire is to collect general information about the schools that can be used in the design of the computer assisted schools information system for administering schools. The system can be used by Namibian schools during admission procedure, storing of officials, learner's records, learners attendance information, and records of examinations grades. The system will also help schools in generating reports needed for the Ministry of Education for the EMIS (Education Management Information System).

The information you provide is entirely confidential and will be kept totally anonymous on my report.

The questionnaire will take about 10 to 15 minutes to be filled.

Thanks you!

School General Information

1. School Name: ....

2. Category of school: (select by putting a tick on the box)

   Primary school ☐   Secondary school ☐   combined school ☐

3. What grades are housed in this school: from Grade................. to Grade.............

4. What is the total number of learners in the school: ....

5. What is the total number of teachers in the school: ....

6. Who does the school administrations: (select by putting a tick on the box)

   Teachers ☐   School Secretary ☐   Principal ☐

7. How many departments do you have in this school: ....

   List the department names below and the subjects that falls under each department

- ....
- ....
- ....
- ....
- ....
- ....
- ....
- ....
- ....
- ....

8. Are there any subjects that does not belong to a department

   If yes which ones? (List them below)   Yes ☐   No: ☐

Introduction

This interview will take about 15 minutes

<u>Part 1 : Learners Record Management</u>

1. How do learners apply to the school?

2. Who does the admission process of learners?

3. How is the admission process done (fill in the form, what is required) and who does the admission?

4. How are learner's records kept?

5. Who assigned learners to classes?

6. How do you keep class lists (hard copies or on a software)?

7. How do you keep syllabuses & Curriculum and study Materials?

8. How do you keep Health care form or health information for the learners?

9. On the following year, how do you start to enrolling learners again? (Where do you keep the previous year's information?

10. Is the method you use to manage student information efficient and credible for you?

(Obtain admission form)

Part 2: Teachers Record Management

1. Is there any form to be filled by the teacher once admitted at a school?

2. Are the teachers records kept at schools or only at the inspector's office or just regional office?

3. If at the office how are they teacher's record kept and where?

4. The teachers Leave forms, are they kept at school or at the inspector's office?

5. The HR policy where are they kept and how are they accessible to teachers and staff members?

6. Is this way of managing teacher's record efficient   and credible for you?

(If there is a admission form for teachers obtain one copy)

Part 3: Learner's Marks

1. How (support media) are learner's marks kept? (each teacher has his own or school principal)

2. Where are the learner's marks kept?

3. Do all teachers have access to all the learners' marks records?

   How, who, Why?
4. How is the calculation of the final exam mark done (weight...cas mark plus exam mark or how)

5. Is this method efficient and credible?

Part 4 : Learner Reports and School life...

1. How (support media) learner's reports are made?

2. How are they kept (always have a copy at school)

3. Who keep the learner's school reports

4. Is it efficient and credible,

Part 5: Report for the Inspector's office

1. What information is usually required by the school inspector's office?

2. How do you collect the information?

3. How often do you send reports

4. Is it efficient,

(Have a copy of the form if there is any)

Part 6 : Attendance Register

1. How is attendance registration done, once daily or for each lesson? Who does it, teacher or class captain?

2. Where do the attendance records stored or kept?

3. What is it used? For decision making purpose or just for record keeping

4. Is this method efficient

Part 7: Classrooms

1. How many classrooms do you have at the school?

2. Are the classrooms given names, or how do you refer to them?

3. How many learners per class?

4. Is it method efficient and credible?

Part 8: School Events

1. Do you have specific events that get planned yearly, or per term?

   If yes which ones and how are they planned?

2. How are the events get advertised to learners, teachers, and staff members

3. If parents are involved how are they informed of school events? Communication with parents in general.

4. Is this method efficient and credible?

Part 9: Payment

1. Who accept the learner's school fees?

2. How are the fees, record managed?

3. Is this method efficient and credible?

2. Questionnaire on Computers in schools

School Questionnaire

Introduction

This questionnaire is part of the research project titled: "***Development of a Computer-Assisted School Information System for Administering Namibian Schools"*** for a Master Thesis at the Polytechnic of Namibia. The aim of this questionnaire is to collect general information about the schools that can be used in the design of the computer assisted schools information system for administering schools. The system can be used by Namibian schools during admission procedure, storing of officials, learner's records, learners attendance information, and records of examinations grades. The system will also help schools in generating reports needed for the Ministry of Education for the EMIS (Education Management Information System).

The information you provide is entirely confidential and will be kept totally anonymous on my report.

 The questionnaire will take about 10 to 15 minutes to be filled.

Thanks you!

Instruction:

Please put a tick on the appropriate box, you can tick more than one where it is necessary.

1. How many computers and laptops does the school have:

   No. of computers: ………………….   No. of laptops: ………………

2. Where are these computers located in the school?

   Classroom   ☐
   Computer Laboratories   ☐
   School library   ☐
   Secretary office   ☐
   Staff office   ☐
   Principal office   ☐

3. Who use these computers?

   Teachers   ☐   How many are used by the teachers   ………………
   Learners   ☐   How many are used by the learners   ……………….
   Principal   ☐   How many are used by the principal   ………………

HODs ☐   How many are used by the HoDs   ………………

Secretaries ☐   How many are used by the secretaries   ………………..

4. What are the computers used for in the school?

Administration ☐
Teaching and learning ☐
Computer literacy training ☐
Internet search ☐
Projects and assignments ☐
E-mail ☐
Presentations ☐
Educational games ☐

5. Who maintain the computers?

Government (a person from regional office) ☐
A Private consultant ☐

6. Who pays for the maintenance of the computers?

The school from school fund ☐
The government ☐

7. Is there internet connection at the school?
Yes: ☐   No: ☐

If yes what type of connection:
ADSL (from Telecom or other organisation) ☐
Via Schoolnet ☐
Dial up connection ☐
Others ☐   Please specify …………………..

Who pays for the internet connection?

School ☐
Specific Organisation ☐   Please state the name: ………………………..

8. Does the school have school (database) software for administering learner's records?

If yes what is the name and the version ……………………………………………………………………………..
Is this software shared between two or more computers or is it only on one computer.
Shared: ☐   On one computer: ☐

9. How are the learner's school reports done and printed?

Using a computer software and printed ☐   Name of software: …………………………………..

Hand written   ☐

10. How is the school time table done?

Using a computer software   ☐   Name of the software: …………………………….
Using a Spread sheet   ☐
Manual   ☐

11. Are there computer laboratories at school? Yes: ☐   No: ☐

If yes, how many laboratories ……………………………….
And how many computers in each lab ……………………………

12. Is computer practice or literacy being taught at the school? Yes: ☐   No: ☐

13. How does the school manage its finances and school fund?
Computer software ☐   Name of the computer software: ……………………………
Manual ☐

Appendix B

3. Data Dictionary

All of the data below will need to be able to be input, output and stored by the system.

Table 1	Attributes	Data Type	Length	Description
Learner	Learner_id	Number	10	Primary key
	First_names	Varchar	20	Learner first name
	Middle_name	Varchar	10	Learner middle name
	Last_name	Varchar	10	Learner last name
	DOB	Date	ddmmyyyy	Learner date of birth
	Gender	Char	10	Gender of a learner
	Nationality	VarChar	15	Nationality of the learner
	Religion	VarChar	20	Religion of the learner
	First Language	VarChar	20	Language spoken at home
	Current_grade	Char	10	The grade the learner is currently
	Previous_grade_failed	Char	10	The grade that a learner failed if any
	Residence Address	VarChar	20	Address of the home where learner stays
	City/town/village	VarChar	15	Village, town or city name
	Postal Address	VarChar	20	Postal address
	Name of father/guardian	VarChar	20	Name of the father or guardian
	Father_guardian_ID	number	10	The ID number of father or guardian
	Name of Mother	VarChar	20	Name of the mother
	Mother_id	number	10	The id number of the mother
	Occupation of Father/ guardian	VarChar	20	Occupation of father or guardian
	Occupation of Mother	VarChar	20	Occupation of mother
	Cell no. father/ guardian	Number	10	Cell phone number of father or guardian
	Cell no. mother	Number		Cell phone number of mother
	Learner_live_with	Char	15	The learner live with mother, father, both or guardian
	Send_correspondence_to	Char	15	To whom should correspondence sent to mother, father, guardian
	Medical_Doctor_name	Char	20	Name of the learner's medical doctor
	Medical_doctor_phone	Number	10	Telephone number of the learner's doctor

Table 2	Attributes	Data Type	Length	Description
Subject	Subject_id	Number	10	Primary key
	Subject_name	Varchar	20	Subject name
	School_level	Varchar	20	Whether lower primary, upper primary, junior secondary or senior secondary
	Grades	Varchar	20	Grades for the school level e.g lower primary is for grade 1-4
	Subject_level	Varchar	20	For grade 11 and 12 if the subject is a core or extended level
	Department_id	Number	10	Link to the department table

Table 3	Attributes	Data Type	Length	Description
Subject_Enrollment	Subject_enrollment_id	Number	10	Primary key
	Learner_id	Number	10	Link to Learner name
	Subject_id	Number	10	Link to subject
	Semester_id	Number	10	Link to Semester table
	Present_grade	Char	20	Currently grade of learner
	Grade_level	Char	20	For grade level whether lower primary, etc
	Subject_level	Char	20	Whether core, extended or ordinary
	Subject_name	Char	20	Name of subject being registered
	First_name	Char	20	First name of learner
	Last_name	Char	20	Surname of learner

Table 4	Attributes	Data Type	Length	Description
Teacher	Teacher_id	Number	10	Primary key
	First_name	Varchar	20	Teacher first name
	Middle_name	Varchar	20	Teacher middle name
	Last_name	Varchar	20	Teacher last name
	DOB	Date	ddmmyyyy	Date of birth of teacher
	ID_number	Number	10	Teacher ID number
	Salary_number	Number	10	Salary reference number of a teacher
	Gender	Char	10	Gender of teacher
	Nationality	Char	20	Nationality of a teacher
	Qualification	Varchar	30	Qualification of the teacher
	Joining_date	Date	ddmmyyyy	Date the teacher joined school
	Experience	Number	10	Number of years of experience
	Postal_Address	String	20	Teacher's postal address
	Residential_address	String	40	Teacher's residential address
	Phone_number	Number	20	Teacher's phone number
	Cell-phone_number	Number	20	Teacher's cell phone number
	Email_address	Varchar	30	Email address of Teacher
	Next_of_keen_name	Varchar	20	Teacher next of keen
	Next_of_keen_relation	Varchar	20	Type of relation with next of keen
	Next_of_keen_phone	Number	10	Phone number of next of keen

Table 5	Attributes	Data Type	Length	Description
Class	Class_id	Number	10	Primary key
	Class_name	Varchar	20	Name of class
	Class_year	Number	10	Year the record of class represent

Table 6	Attributes	Data Type	Length	Description
Departments	Dept_id	Number	10	Primary key
	Dept_name	Varchar	20	Name of the department
	Head_Dept_name	Varchar	20	Name of the Head of department
	Teacher_id	Number	10	Link to head of department teacher
	HOD_first_name	Varchar	20	First name of HOD
	Hod_last_name	Varchar	20	Surname of HOD

Table 7	Attributes	Data Type		Length		Description
Teacher_Subject	Teacher_id	Number		10		Primary key
	Subject_id	Number		10		Link to subject
	Taught_count	Number		10		Counting number of experience
	Teacher_first_name	Varchar	20	Varchar	20	First name of teacher
	Teacher_last_name	Varchar	20	Varchar	20	Surname of teacher
	Subject_Name	Varchar	20	Varchar	20	Name of subject being taught
	Subject_level	Varchar	20	Varchar	20	Whether core, or extended
	School_level	Varchar	20	Varchar	20	Whether lower primary or junior secondary
	Language_level	Varchar	20	Varchar	20	Whether first or second language

Table 8	Attributes	Data Type	Length	Description
Attendance	Attendance_id	Number	10	Primary key
	Learner _id	Number	10	Link to student
	Date_attendance	ddmmyyyy	10	Date of attendance register
	Attendance_status	Char	10	Status absent or present
	Semester-id	Number	10	Link to semester

Table 9	Attributes	Data Type	Length	Description
Semester	Semester_id	Number	10	Primary key
	Semester-name	Number	10	Name of the semester
	Semester_start_date	ddmmyyyy	10	Date of the start of semester
	Semester_end_date	ddmmyyyy	10	Date of the end of semester

Table 10	Attributes	Data Type	Length	Description
School_fee_Payment	Payment_id	Number	10	Primary key
	Learner-id	Number	10	Link to learner
	Semester-id	ddmmyyyy	10	Link to semester
	Amount_paid	Number	10	Amount paid
	Outstanding	Number	10	Amount outstanding
	Status	Char	10	Status complete payment or not
	Present_grade			

Table 11	Attributes	Data Type	Length	Description
Events	Event_id	Number	10	Primary key
	Event-name	Varchar	20	Name of the Event
	Date_ Event	ddmmyyyy	10	Date of the Event
	Semester_id	Number	10	Link to semester

Table 12	Attributes	Data Type	Length	Description
School	School Name	Number	10	Primary key
	School_type	Number	10	Typeof school wether primary or secondary
	Region	VarChar	20	Name of the region
	Physical Address	VarChar	20	Address of the school
	Postal Address	VarChar	20	Postal address of the school
	Regional_office	VarChar	15	Regional office where school is reporting
	Circuit_office	VarChar	15	Circuit office where school is reporting

Table 13	Attributes	Data Type	Length	Description
Official_Documents	Document_id	Number	10	Primary key
	Document-name	VarChar	10	Name of the document
	Document_type	VarChar	20	Type of the document
	Date_uploaded	VarChar	20	Date on which the document is uploaded

Table 14	Attributes	Data Type	Length	Description
School_attended_general	Learner_id	Number	15	Link to learner table
	School_att_id	Number	15	Primary key
	Exemp_comp_sch	Char	20	Yes or no whether exempted from compulsory education
	Exemp_Date	Date		Date a learner was exempted
	Age_on_init_entry	number	10	Age on initial entry to school

Table 15	Attributes	Data Type	Length	Description
School_attended_specific	Learner_id	Number	15	Link to learner table
	School_att_id	Number	15	Primary key
	Admission_no	Number	15	Admission number
	Name_of_School	Char	100	Name of previous school
	Medium	Char	100	The language of instruction
	Admission_date	Date		Date admitted at previous school
	Admission_grade	Char	100	Grade admitted at previous school
	Departure_date	Date		Date departed previous school
	Departure_grade	Char	100	Grade when departed previous school

Table 16	Attributes	Data Type	Length	Description
Physical Condition/handicaps	Learner_id	Number	15	Link to learner table
	Condition_date	Date	15	Date the condition recorded
	General_health	Char		General health
	Problem_Disability	Char		Problem or disability
	How_prob_delt_wth	Char		How the problem is being dealt wih
	Prev_Illness	Char		Previous illness
	Year	Number		Year it was recorded
	Class	Char		Grade the learner is
	Remark	Char		Remarks on condition or handicapness

Table 17	Attributes	Data Type	Length	Description
Psycho_Learning_Problem	Learner_id	Number	15	Link to learner table
	Test_date	Number	15	The date the test was done
	Name_of_test	Char	20	Name of the test
	Grade	Date		The grade of the learner at a time
	Tester	number	10	Name of the tester
	Remark	Char	400	Remark from the test
	Learning_disab_nature	Char	400	Learning disability or problems or difficulties
	Learning_disab_Action	Char	400	Action taken on the difficulties
	Learning_disab_results	Char	400	Results noted
	Problem_nature_offense	Char	400	Problematic behaviors nature of offense
	Problem_action	Char	400	Action taken on the problematic behavior
	Problem_results	Char	400	Result noted after the action

Table 18	Attributes	Data Type	Length	Description
Learner_General_Information	Learner_id	Number	15	Link to learner table
	Outstanding_aptitude	Char	400	Outstanding aptitude (e.g. language, numbers, art, music, etc)
	Outstanding_interest	Char	400	Outstanding interest (e.g. working with people, or machine, etc)
	Out_achieve_academic	Char	400	Academic outstanding achievement
	Out_achieve_Extra_curri	Char	400	Extra-curricular outstanding achievement attained
	Vocational_choice_learner	Char	400	Vocational choice-career chosen by learner
	Vocational_choice_parent	Char	400	Vocational choice-career chosen by parents
	Vocational_choice_counsellor	Char	400	Vocational choice –career chosen by counsellor
	Vocational_choice_broad_fields	Char	400	Broad vocational field (e.g. natural science, technical, commerce, etc)
	Vocational_choice_specific_careers	Char	400	Specific career chosen
	General_remarks	Char	400	General remarks /recommendations/ interviews

Appendix C

Codes
Code for Learner's display Page with search item:

```
select

"RESIDENTIAL_ADDRESS", "POSTAL_ADDRESS", "MIDDLE_NAME", "LAST_NAME",
"GENDER", "NATIONALITY",
"RELIGION","HOME_LANGUAGE","MEDICAL_DOCTOR_PHONE","LEARNER_ID","FIRST_NAM
E","CITY_TOWN",

"NAME_FATHER_GUARDIAN","NAME_OF_MOTHER",
"OCCUPATION_OF_FATHER_GUARDIAN", "OCCUPATION_MOTHER",
"CELL_NO_FATHER_GUARDIAN", "CELL_NO_MOTHER", "FATHER_GUARDIAN_ID_NO",
"MOTHER_ID_NO", "AGE", "PRESENT_GRADE", "PREVIOUS_GRADE_FAILED",
"LEARNER_LIVES_WITH", "SEND_CORRESPONDENT_TO", "MEDICAL_DOCTOR_NAME",
"DATE_OF_BIRTH" from   "LEARNER"

where

(


instr(upper("RESIDENTIAL_ADDRESS"),upper(nvl(:P2_REPORT_SEARCH,"RESIDENTIAL_ADDR
ESS"))) > 0  or
instr(upper("POSTAL_ADDRESS"),upper(nvl(:P2_REPORT_SEARCH,"POSTAL_ADDRESS"))) > 0
or instr(upper("MIDDLE_NAME"),upper(nvl(:P2_REPORT_SEARCH,"MIDDLE_NAME"))) > 0
or instr(upper("LAST_NAME"),upper(nvl(:P2_REPORT_SEARCH,"LAST_NAME"))) > 0  or
instr(upper("GENDER"),upper(nvl(:P2_REPORT_SEARCH,"GENDER"))) > 0  or
instr(upper("NATIONALITY"),upper(nvl(:P2_REPORT_SEARCH,"NATIONALITY"))) > 0  or
instr(upper("RELIGION"),upper(nvl(:P2_REPORT_SEARCH,"RELIGION"))) > 0  or
instr(upper("HOME_LANGUAGE"),upper(nvl(:P2_REPORT_SEARCH,"HOME_LANGUAGE"))) >
0  or instr(upper("FIRST_NAME"),upper(nvl(:P2_REPORT_SEARCH,"FIRST_NAME"))) > 0  or
instr(upper("CITY_TOWN"),upper(nvl(:P2_REPORT_SEARCH,"CITY_TOWN"))) > 0  or
instr(upper("NAME_FATHER_GUARDIAN"),upper(nvl(:P2_REPORT_SEARCH,"NAME_FATHER
_GUARDIAN"))) > 0  or
instr(upper("NAME_OF_MOTHER"),upper(nvl(:P2_REPORT_SEARCH,"NAME_OF_MOTHER"))
) > 0
orinstr(upper("OCCUPATION_OF_FATHER_GUARDIAN"),upper(nvl(:P2_REPORT_SEARCH,"O
CCUPATION_OF_FATHER_GUARDIAN"))) > 0  or
instr(upper("OCCUPATION_MOTHER"),upper(nvl(:P2_REPORT_SEARCH,"OCCUPATION_MOT
HER"))) > 0
orinstr(upper("CELL_NO_FATHER_GUARDIAN"),upper(nvl(:P2_REPORT_SEARCH,"CELL_NO_
FATHER_GUARDIAN"))) > 0  or
instr(upper("CELL_NO_MOTHER"),upper(nvl(:P2_REPORT_SEARCH,"CELL_NO_MOTHER"))) >
0  or instr(upper("PRESENT_GRADE"),upper(nvl(:P2_REPORT_SEARCH,"PRESENT_GRADE")))
> 0 or
instr(upper("PREVIOUS_GRADE_FAILED"),upper(nvl(:P2_REPORT_SEARCH,"PREVIOUS_GRA
```

DE_FAILED"))) > 0 or
instr(upper("LEARNER_LIVES_WITH"),upper(nvl(:P2_REPORT_SEARCH,"LEARNER_LIVES_WIT
H"))) > 0 or
instr(upper("SEND_CORRESPONDENT_TO"),upper(nvl(:P2_REPORT_SEARCH,"SEND_CORRES
PONDENT_TO"))) > 0 or
instr(upper("MEDICAL_DOCTOR_NAME"),upper(nvl(:P2_REPORT_SEARCH,"MEDICAL_DOCT
OR_NAME"))) > 0

Learner Cumulative Record Card

Display Psycho_learning_problem

select p.test_date, p.grade, p.tester, p.remark, p.learning_disab_action,
p.problem_nature_offense, p.problem_action, p.problem_results from
psycho_learning_problem p, learner l where p.learner_id = l.learner_id AND p.learner_id =
:P2_Report_search

Attendance View

select a.attendance_date,a.learner_first_name, a.learner_last_name, a.semester_name,
a.attendance_status from attendance a, learner l where a.learner_id = l.learner_id and
a.learner_id = :P2_Report_search and a.attendance_status = 'Absent'

Learner Subjects View

select se.subject_name, se.subject_level, se.language_level, se.year from
subject_enrollment se, learner l where se.learner_id = l.learner_id and se.learner_id =
:P2_Report_search

Learner's marks View

select s.subject, s.mark, s.grade, s.semester_name, s.year from learner_marks s, learner l
where s.learner_id = l.learner_id and s.learner_id = :P2_Report_search

View the subjects Page code

select subject_name, grade_level, subject_level, language_subject, language_level from
subject where (school_level = :P6_select_school_level or :P6_select_school_level = -1)