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DEVELOPING AND IMPLEMENTING AN INFORMATION COMMUNICATION TECHNOLOGY MODEL FOR A PRIMARY SCHOOL

TECHNOLOGY MODEL FOR A PRIMARY SCHOOL
by
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Dissertation submitted in fulfilment of the requirements for the degree
Master of Technology: Quality
in the Faculty of Engineering
at the Cape Peninsula University of Technology
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DECLARATION

"I hereby declare that this dissertation submitted for the degree Magister Technologiae at Cape Peninsula University of Technology, is my own original unaided work and has not previously been submitted to any other institution or higher education. I further declare that all sources cited or quoted are indicated and acknowledged by means of a comprehensive list of references".

Meagan Arderne

Moderno

November 2008

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DEDICATION

This study is dedicated to my parents, Leonard and Charmaine for their love and support. Thank you for being the loving, uplifting parents.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude and appreciation to the following individuals:

My husband Russel for his guidance and upliftment.

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My supervisor Prof. Watkins for imparting his knowledge and guidance.

Professor Willie Van Ryneveld for his guidance.

ABSTRACT

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Degree: Mtech: Quality

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Technology Model for the Holy Cross Sisters' School.

University: Cape Peninsula University of Technology

Department: Industrial and System Engineering.

Supervisor: Professor JA Watkins

Date: 13 October

Key Words: Information Communication Technology (ICT), innovation, pedagogy,

technology, infrastructure, education.

While the necessary Information Communication Technology (ICT) infrastructure at the Holy Cross Sisters' School (HCSS) has been established, there has been little evidence of the successful integration of ICT into the school. While traditional teaching methods are still being practiced, ICT integration into the curriculum has been non-existent and mundane administrative tasks are still being performed manually. Furthermore, management has no real vision in place with regards to ICT integration at the school. Due to the fact that the HCSS has not optimally used its ICT capabilities results in administrative processes being inefficient and impacting adversely on the quality of the education provided.

The objectives of this research study are to develop a model that mitigates the research problem with focus on improving administrative processes, integrating ICT into the curriculum, and combining ICT with traditional teaching methods to exponentially improve upon the efficiency of teaching and learning.

The research methodology for this dissertation will fall within the ambit of action research, using both qualitative and quantitative research paradigms. The research question that will form the crux of this dissertation reads as follows: 'What mechanistic

approach can be deployed at the HCSS to integrate ICT within the organization to improve the quality of education and improve on the efficiency of internal processes?'

Observations, focus groups and a survey will serve as data collection methods for this research. Data collected will be analyzed using descriptive and inferential statistics.

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GLOSSARY OF TERMS

Pedagogy:

An educational approach characterized by teacher-centredness. The teacher is viewed as an authority figure and students are not generally involved in decisions/actions in regard to learning. Related concepts include: directed learning (Herod 2002:**O**nline).

Information

Communication

Technology:

The technology used to manage information and aid communication' (Elston 2007: Online).

CHAPTER 1: SCOPE OF THE RESEARCH

1.1 INTRODUCTION AND BACKGROUND

More often than not, primary schools in South Africa are still without technological capabilities (computers) due to a number of constraints, the most prevalent being the lack of money, infrastructure, know-how and/or advice. Some schools that have the equipment, may not have the necessary processes in place to use the technological advancement to their benefit.

It is a common fact that individuals, who have never used computers before, are generally afraid of using them as a learning or business mechanism. Most corporate entities usually have a model or a process to follow when it comes to computer usage, as well as computer literacy and training courses for it's employees. Research has shown that the major role of Information Communication Technology (ICT) is to provide organisations with strategic advantage by facilitating problem solving, increasing productivity and quality, improving customer-service, enhancing communication and collaboration and enabling business process reengineering (Turban,Mclean & Wetherbe 2002:V).

The governing body of the HCSS, along with the head mistress, has requested that an ICT model be developed and implemented at the school, to enable the utilisation of the infrastructure effectively and in turn have a positive effect on efficiency. The governing body is of the opinion that the infrastructure is currently of little or no use since it is not being used effectively or efficiently. A consensus has been reached that educators should be empowered to use technology to enhance classroom lessons as well as administrative tasks. In turn, learners have to be educated to attain a high level of computer literacy.

Staff had been informed about the project and was urged to accommodate the ongoing research during the projects' duration. Making sure that all the educators are aware of what the objectives are and what the benefits will entail, would ensure that cooperation is

elicited from educators. Demonstrations will also be conducted at certain stages of the project. Quarterly progress reports will be delivered at governing body meetings.

The aim of this study is to formulate a conceptual model that facilitates improved computer literacy among educators and learners. The model should provide for computer training, curriculum development for the integration of technology in the classroom, and an effective documentation and administrative system. The model should furthermore have the potential to, from a practical perspective, culminate in a viable mechanism to optimise the use if ICT within the HCSS.

Currently, mundane manual processes are being performed at the school on a regular basis, which include updating mark sheets, reports and lesson plans, that are time consuming and expensive. Furthermore, staff members do not have access to official documentation and/or school policies. Documentation that should be readily and freely available to staff members are still paper based and are stored in a filing cabinet that most staff members find too cumbersome to go through in an effort to find what they seek. This dispensation is unacceptable, and as a secondary objective of this study, is to make recommendations of how this situation can be mitigated.

1.2 RESEARCH PROCESS

The research process to be followed in this dissertation, the following:

- Determine the 'field of study' for the proposed research.
- Identify a specific complex problem within a researchable application area, which furthermore falls within the ambit of the identified field of study and of the niche area of the faculty in which the research study will be undertaken.
- Conduct a holistic survey of the functional area in which the complex problem exists, to determine the impact of the problem on the specific area of application and the value the proposed research may bring.

- Conduct an abbreviated literature review on the subject matter being investigated. The purpose not only provides insight into the complexity of the problem, but also to provide insight into the literature pertaining to the field of study of the proposed research.
- Describe and formulate the research problem.
- Describe and formulate the research question and associated investigative questions.
- Select an appropriate research design and methodology, which includes the data collection design and methodology.
- Determine the key research objectives for the proposed research.
- Document the research process, which will be followed for the proposed research and formulate an associated work plan.
- ldentify the limitations, which may impact on the proposed research.
- Based on above, formulate a formal research proposal and submit for approval.
- Establish a structured working relationship with the allocated supervisor.
- > Conduct an in depth literature review on the subject being researched.
- > Collect, analyse and interpret the research data.
- > Write up the dissertation.
- > Proofread the dissertation and submit for formal vetting.

1.3 BACKGROUND TO RESEARCH PROBLEM

Currently, the HCSS has no ICT model or system in place. Attempts have been made to develop the much needed system, but have proven to be unsuccessful due to lack of staff participation/motivation, proper planning and research, as well as lack of knowledge. No formal model or guidelines have been formulated to optimise the existing ICT infrastructure effectively and efficiently. Curriculum and ICT integration has been very limited due to a lack of training and staff empowerment. Learners are not being skilled in terms of computer literacy, and are therefore not using computers to optimise their education process.

1.3.1 Research Problem Statement

The research problem statement for this dissertation formulated against the above background, reads as follows: "The poor deployment of ICT within the HCSS resulting in inefficient processes, adversely impacting on the quality of education provided and efficiency of internal processes".

1.4 THE RESEARCH QUESTION.

Forming the crux of the research, the following research question will be researched within the ambit of this dissertation: "What mechanistic approach can be deployed at the HCSS to integrate ICT within the organisation to improve the quality of education and furthermore to improve on the efficiency of internal processes?"

1.4.1 Investigative Questions

The investigative questions to be researched in support of the research question, reads as follows:

- ➤ How can learner computer literacy be improved at the HCSS?
- Can ICT serve as a successful teaching mechanism?
- > How can the implementation of an electronic documentation system improve efficiency?
- What approach can be adopted to technologically empower educators and administrative staff?

1.5 RESEARCH DESIGN AND METHODOLOGY

Action research will serve as the research method in this dissertation, using both qualitative and quantitative research paradigms. 'Action research', is described by Gummesson (2000:116), as "a method of doing case study research". According to Collis and Hussey (2003:65), "action research is a type of applied research, designed to find an

effective way of bringing about a conscious change in a partly controlled environment". The following serves as an example: A study aimed at improving communications between management and staff in a particular company. It is usual to conduct 'action research' within 'a single organisation' and it is therefore similar to a case study approach in many of its procedures. The main aim of action research is to enter into a situation, attempt to bring about change and monitor results, as in the instance of this research study. Coghlan and Brannick (2002:6-7), citing Gummesson (2000), list the following most salient features of 'action research':

- > Action researchers take action.
- Action science always involves two goals: 'Solve a problem for the client' and to 'contribute to science'. This means being 'a management consultant' and an 'academic researcher' at the same time.
- Action research is interactive. It requires co-operation between the researcher and the client personnel, and continuous adjustment to new information and new events.
- Action science is applicable to the understanding, planning and implementation of change in business firms and other organisations.
- It is essential to understand the ethical framework, values and norms within which action research is used in a particular context.
- Action research can include all types of data gathering methods, but requires the total involvement of the researcher.
- > Constructively applied pre- understanding of the corporate environment and of the conditions of business is essential.
- Management action research should be conducted in real time, though retrospective action research is also acceptable.
- > The management action research paradigm requires its own quality criteria.

Coghlan and Brannick (2002:17-18), describes the action research cycle as follows:

➤ **Diagnosing:** Involves naming what the issues are, however provisionally as a working theme on the basis of which action will be planned and taken.

- Planned action: Planning action follows from the analysis of the context and purpose of the project, the framing of the issue and the diagnosis, and is consistent with them.
- **Taking action:** Plans are implemented and interventions are made.
- Evaluating action: The outcomes of the action both intended and unintended, are examined with a view to seeing:
 - > If the original diagnosis was correct
 - > If the action taken was correct
 - > If the action was taken in an appropriated manner.
 - The above, which feeds into the next cycle of diagnosis, planning and action.

1.5.1 Data Collection

Three data collection methodologies will be deployed in the execution of this research study, namely a questionnaires, participant observation and a focus group.

Questionnaires, fall within the ambit of a broader definition of 'survey research' or 'descriptive survey'. For absolute clarity, the concept of 'survey' is defined by Remenyi, Williams, Money and Swartz (2002:290), as "...the collection of a large quantity of evidence usually numeric, or evidence that will be converted to numbers, normally by means of questionnaire". A questionnaire is a list of carefully structured questions, chosen after considerable testing with a view to elicit reliable responses from a chosen sample. The aim is to establish what a selected group of participants do, think or feel. A positivistic approach suggests structured 'closed' questions, while a phenomenological approach suggests unstructured 'open-ended' questions for the collection of primary data using questionnaires.

Focus groups serve as a data collection methodology for the research methods falling within the context of either the positivistic (quantitative) or phenomenological (qualitative) research paradigms. A focus group according to Cooper & Schindler (2006:212-216), is a panel of people, typically made up of six to ten participants, led by

trained facilitator, who meet for 90 minutes to 2 hours. Cooper & Schindler (2006:213-216), states that in traditional focus groups, participants meet face to face, usually in specialised facilities that enable respondents to interact in a comfortable setting, while being observed by a sponsoring client.

Observation serves as a data collection methodology for research methods falling within the context of either the positivistic (quantitative) or phenomenological (qualitative) research paradigms. Collis and Hussey (2003:171-172), describe that there are two ways in which observation can be conducted, namely 'Non-participant observation' and 'Participant observation'. In using either of the two, the researcher is cautioned against observer bias, which may arise, such as when one observer interprets an action differently from a colleague. Participant observation has the researcher fully involved with the participants and the phenomena being researched. Furthermore, this type of research has the objective to provide the means of obtaining a detailed understanding of values, motives and practices of those being observed.

The sample size for the observation will be 10 students per grade, culminating in 80 students as a sample frame. Twenty educators will form the sample frame for the research questionnaire and focus groups.

1.6 RESEARCH ASSUMPTIONS

It is assumed that the technology infrastructure as implemented at the HCSS is not only underutilised, but not optimally used for the applications it was originally designed for.

1.7 RESEARCH CONSTRAINTS

The research constraints pertaining to this dissertation, is as follows:

- A lack of staff participation.
- > Certain students may prove to have a learning handicap.

Certain staff members and students have had some advanced exposure to technology within a learning environment and may be biased in their answers in the survey.

1.8 CHAPTER AND CONTENT ANALYSIS

The chapter and content analysis, which will pertain to this dissertation, reads as follows:

Chapter 1 - Scope of the research: In this chapter, a holistic perspective will be provided of the scope of the research.

Chapter 2 – A holistic perspective of the Research Environment: In this chapter, a holistic perspective will be provided of computer technology utilisation at the HCSS.

Chapter 3 – ICT and its role in the schooling system: A Literature Review: In this chapter, a literature review will be conducted on existing ICT models and its utilisation.

Chapter 4 – ICT Confidence Survey Design and Methodology: In this chapter, the survey design and methodology to be conducted will be elaborated upon.

Chapter 5 – Data analysis and interpretation of results: In this chapter, data gleaned from the research survey conducted within the ambit of chapter 4 will be analysed and interpreted.

Chapter 6 – Conclusion and Recommendations: In this chapter, the research will be concluded. Key elements highlighted in chapter 1 will be revisited and recommendations will be made to not only mitigate the research problem but also to provide answers to the research question and associated investigative questions.

1.9 KEY RESEARCH OBJECTIVES

The aim of this study is to formulate a conceptual model that facilitates improved computer literacy among educators and learners. The model should provide for computer training, curriculum development for the integration of technology in the classroom, and an effective documentation and administrative system. The model should furthermore have the potential to, from a practical perspective, culminate in a viable mechanism to optimise the use if ICT within the HCSS.

1.10 SIGNIFICANCE OF PROPOSED RESEARCH

The significance of this research lies embedded in the in the fact that no ICT model for primary education institutions in the Western Cape, exist. The formulation of an ICT model at the HCSS has the potential:

- > To be expanded to other primary schools in the province.
- > To significantly improve the quality of learning in primary schools.
- > To improve and optimally utilise current administration processes.
- > To establish ICT as a beneficial learning mechanism to the benefit of learners and schools alike.

CHAPTER 2: A HOLISTIC PERSPECTIVE OF A RESEARCH ENVIRONMENT

2.1 INTRODUCTION

The HCSS in an independent primary school with a contingent of 465 learners and 30 staff members. In 2005, the Holy Cross Parent Association raised sufficient funds to acquire equipment for the establishment of a computer centre. Twenty-two Mecer Premium computers were purchased along with a Mecer server. The new computers and server came pre-installed with the necessary hardware and software components. During 2006, the school receiving a donation of twenty-one working computers from a tertiary institution. A further eight Hewlett Packard computers were in addition acquired during 2008, bringing the total number of computers to fifty-one. This would mean that every child had his/her own computer during a computer lesson and each classroom would have a computer installed. The principal, deputy principal and administrative staff (secretary and the bursar) have computers in their respective offices. The staffroom also has two computers installed to facilitate staff access. All the computers in the building are networked and have Internet access.

The school has steadily been upgrading hardware peripherals, i.e. printers, data projectors over the past three years. A data projector has been acquired and installed for mass communication and a mobile projector acquired for classroom use. The school has also acquired a laptop and USB memory sticks for senior management staff. In the event of the Internet being unavailable via the Local Area Network (LAN), a dialup modem is in place to ensure that the Internet is accessible. The email server resides off campus, and is maintained by an external person employed by the Education Department. This in essence means that email has to be downloaded from this external server several times during the day onto the server at the HCSS.

There appears to be a lack of technical knowledge and experience amongst the Information Technology (IT) literate staff members. The IT co-ordinator has not

had any formal training or holds a formal qualification relating to IT. This is particularly evident when equipment needs to be maintained or new equipment, beneficial and best suited for the environment and purpose, needs to be purchased. The school management team admits that the current ICT infrastructure is not being used effectively and efficiently as it should be. They also concluded that should the infrastructure be used optimally, it would benefit the school exponentially in terms of improving administrative tasks, enhancing learning experiences, improving teaching mechanisms and market the school on a more competitive level.

2.2 ICT CULTURE AT THE SCHOOL

Access to information on the network is limited to a 'need to see' or a 'need to know' basis. Educators are not encouraged to develop their ICT skills, nor are they empowered to perform ICT related tasks. This leaves all ICT related issues to be addressed by the IT co-ordinator. This situation often results in one person doing most, if not all computer related work. This particular culture can also be attributed to the lack of experience amongst both educators and IT co-ordinator.

Some of the unique issues pertaining to ICT utilisation, the following:

- Educators do not have individual, unique user accounts to log in with. This means that no home directory is available to them for saving work in. Furthermore that everybody logs in with a generic account and saves their work to a generic, common folder. Everybody then has access to each others work.
- The educators who make use of certain ICT functions at the school still use 'floppy disks' to save their work on. This in turn limits the amount of work, or rather the size of the file, they are able to save. Floppy disks can also prove to be very unstable at times.
- > Currently there is no clear ICT vision. There is evidence that the existing policies and procedures regarding ICT are inadequate, and is often altered to suit individual and situational needs. Support from top management is not apparent to the staff. This affects the buy-in from staff members, adversely. As a result, no innovative development takes place.

- > The lack of ICT knowledge and experience hinders the development of effective and efficient policy and procedure formulation.
- > Current software programs are not optimally utislised and in many instances, are not suitable for the purpose it is intended.

2.3 ICT LITERACY SKILLS AMONGST LEARNERS

All grades (Gr. R – Gr. 7), have one hour sessions of computer literacy classes once a week. No set curriculum for computer skills at primary level currently exists, leaving the IT co-ordinator to develop a curriculum structure, which is more often that not unsuitable to the learners needs. Furthermore, learners spend the entire hour playing computer games as opposed to doing constructive learning which is conducive to developing their ICT skills.

The few educational software packages, which are being utilized for computer literacy training are only suitable for learners up to grade three. Learners have no knowledge of how to use word processing, presentation or spreadsheet packages. Furthermore, learners are not encouraged to use electronic encyclopedias or Internet resources for project research. Class projects are handwritten as opposed to being typed and printed. Learners are however familiar with logging on procedures and how to use a computer mouse. There is a lack of basic computer skills amongst learners, and no exposure to the inner workings of a computer is provided. Simple functions like using the keyboard shortcuts and extended use of the mouse or computer peripherals, are significantly lacking.

It appears that there has been some effort directed at investigating and acquiring suitable software packages as well as training for the IT co-ordinator so as to use existing software optimally. Due to budget constraints and knowledge constraints to a certain degree, acquisition of suitable software packages has not been made. ICT usage in the computer centre is limited to 'entertainment' as opposed to 'enrichment'. The principal of the HCSS is of the opinion that this particular facility is not being used optimally, and that very little effort has been made to improve or change the situation.

2.4 ICT LITERACY SKILLS AMONGST EDUCATORS

Educators who have recently completed their teachers' qualification have had a certain level of exposure to ICT and are therefore equipped for very basic computer usage skills. They display a level of basic working knowledge with regards to Microsoft Office components such as MS Word and Excel. This status quo as opposed to educators who have been teaching for a number of years and who have a total lack of knowledge when it comes to ICT and associated benefits. The majority of the educators still conform to the traditional manner of completing tasks and conducting lessons, and is invariably not keen to make use of ICT. Some of the educators refer to it as "a fear of the unknown" (Swanepoel 2007:Informal Discussion).

At the HCSS, it is evident that there is a low level of ICT integration in the school, adversely affecting educators and learners alike. Furthermore, there appears to be a lack of motivation and empowerment from management (the principal, the board and deputy principal) to improve the situation. As a result, most of the educators have managed thus far with absolutely no ICT exposure at all. There's no evidence that training has been offered to the educators or that educators have requested it.

Only a small number of educators has taken the initiative to 'educate' themselves on issues pertaining to ICT and therefore reap the benefits. Although they are relatively ICT competent, the general consensus amongst these educators are that access to most documents that affect them directly, such as letterheads, assessment templates, hymns, policies, are limited or unavailable. Educators have not been introduced to email, or how to make use of it as a communication tool.

Administrative staff (the bursar and secretary) are however reasonably computer literate. The principal and deputy principal have a working knowledge of the concept and also seem to have a low level of ICT competence. This scenario as opposed to learners and educators who have not been properly introduced to computers and its hardware or peripherals.

2.5 STAFF TRAINING

Due to a lack of training, educators have indicated that they are uncomfortable with integrating ICT into their classrooms. Most educators still make use of transparencies, overhead projectors and the blackboard as opposed to data projectors and computers. Learners are also not referred to the computer centre to conduct research for projects and are often asked to go to the library and consult encyclopedias as opposed to using the Internet. Furthermore, learners are not encouraged to type projects, but rather to write the document by hand. More often than not the traditional approach to lesson planning is used as opposed to using an automated process. Only a few educators who have empowered themselves use the online resources available (the Internet, Encarta), when planning lessons.

There appears to be a general misconception that technology is either unreliable or is replacing the educator, and therefore limits contact time with learners. Certain educators are also of the opinion that bringing technology into the classroom may be a distraction to learners, and therefore hinder the learning process. Learners are not encouraged to go and research topics using the Internet.

2.6 ICT CURRICULUM INTEGRATION

Educators, who welcome the idea of ICT in the classroom, have indicated that they do not have the knowledge or guidance to integrate ICT optimally. Classroom integration is also impacted upon due to the lack of ICT capabilities amongst learners and educators alike and proper training in this respect has not been provided to mitigate the problem. Previous attempts to provide training has been unsuccessful and according to the principal, can be attributed to the lack of buy-in and confidence from staff members.

2.7 ICT AND ADMINISTRATIVE TASKS

Mundane manual processes being performed at the school on a regular basis i.e. updating mark sheets, reports and lesson plans are time consuming and expensive.

Most of these processes have not been computerized and is restricted to being performed by one person only. Figure 2.1 serves as a graphical depiction of the current manual processes being utilised within the HCSS. Staff members have limited, if any knowledge of official school procedures and policies and attribute this to the fact that they do not have ready access to official documentation and/or school policies. Educators concede that should documentation be made electronically available, they would still have trouble accessing it.

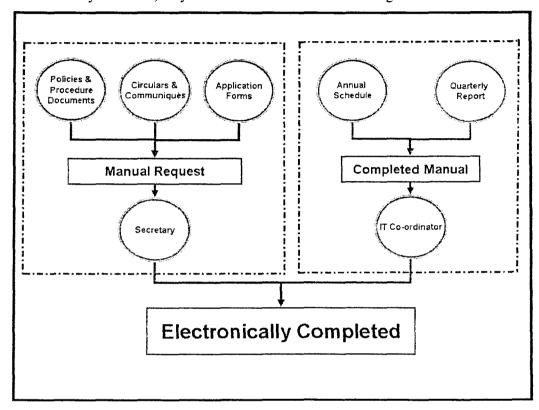


Figure 2.1 Current manual processes.

2.7.1 School Communication

No central repository for circulars and communiqués, accessible to educators, exist. Educators are responsible for drafting respective circulars and communiqués, which are then proof read by a designated educator. Once the necessary changes are made, it is then sent to the secretary to be typed and photocopied. Before the circular is photocopied and distributed it is yet again proof read. This often results in the processes having to be repeated the following year proving to be very time consuming. Figure 2.2 serves as a graphical depiction of the current communication process deployed within the HCSS.

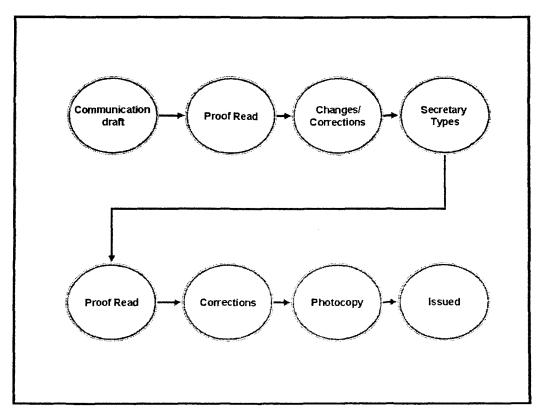


Figure 2.2 HCSS Communication Process

Documentation that should be readily and freely available to staff members are still paper based and are stored in a filing cabinet, which proves to be extremely cumbersome should a document need to be extracted therefrom.

The principal has indicated that an Intranet would be the desired means of establishing a central repository. The existing student database only records the learners' residential address and particulars pertaining to parental figures, school fees and contact details. No provision has been made for academic records or circulars and communiqués. This inevitably means that academic information is stored manually on paper.

2.7.2 Application Process

Prospective school parents are required to physically come and request a prospectus and application forms as it is not available online via a website. This proves to be very tedious and time consuming for administrative staff. Once these forms have been completed, it then needs to be returned to the school, manually

entered into the system and reviewed by the principal. Figure 2.3 serves as a graphical depiction of the current application process.

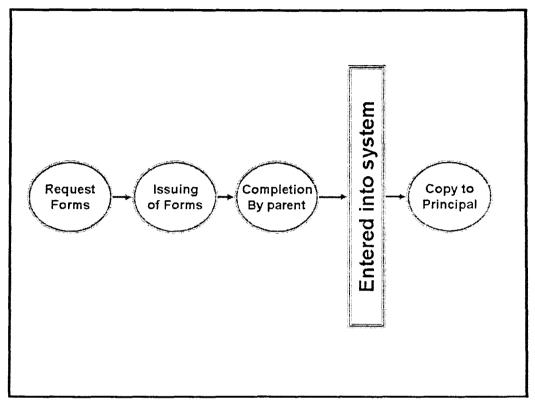


Figure 2.3 Application Process

The HCSS does not have a website accessible to the general public. A domain name or address has been acquired by an external entity on behalf of the school, but no attempt has been made to develop a website. Parents are therefore dependent on circulars issued for information regarding the school and its activities. The school calendar is only available from the administrative office and is not displayed online. Furthermore, staff members and board members are not known to the general parent body. The school does not make use of email as a means of communication with parents, who have email facility at their disposal.

In summary, the schools' primary means of communication with parents are via circulars, telephone and fax, which are very costly methods of communication. All of the documentation listed above could be easily held and maintained on a database, which is accessible to the public.

2.7.3 Quarterly Reporting

Reporting activities such as quarterly learner assessments are recorded manually as are the quarterly reports issued to learners. Educators are not familiar with the process of merging reports online. Once all assessments have been recorded manually, it is then passed on to the IT co-ordinator who then enters it on a spreadsheet. This spreadsheet is printed and returned to educators for review. The review process includes the principals' input. The spreadsheet is then returned to the IT Co-ordinator who makes necessary changes and amendments. This data is merged by the IT Co-ordinator onto a report template, printed and sent back to the teachers for review, comment entries and signatures. The reports are handed back to the principal for review. Any changes and corrections are subsequently made. Report comments are currently handwritten as opposed to being typed and merged onto the report along with the assessment marks. During this administrative period, computer classes are cancelled to accommodate the capturing process, which can take up to two weeks to complete. Figure 2.4 serves as a graphical depiction of the current quarterly reporting process.

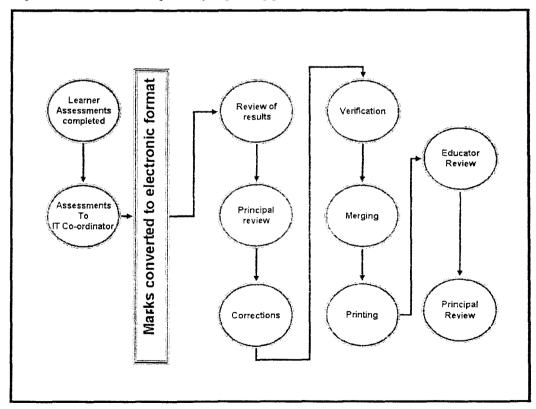


Figure 2.4 The Quarterly Reporting Process

2.7.4 Annual Schedules

Departmental schedules are also completed by the IT co-ordinator. This means that certain tasks are often duplicated, errors are frequently made and it is very time consuming. The IT co-ordinator populates a spreadsheet with the learners assessment marks for the year along with the learners' details. Figure 2.5 serves as a graphical depiction of the current annual schedule compilation process. Ideally, educators should be able to enter their own assessments onto a schedule and merge the reports, which would leave the IT co-ordinator with only the printing to be done. Educators should also have access to the schedule templates and be able to complete their own schedules electronically.

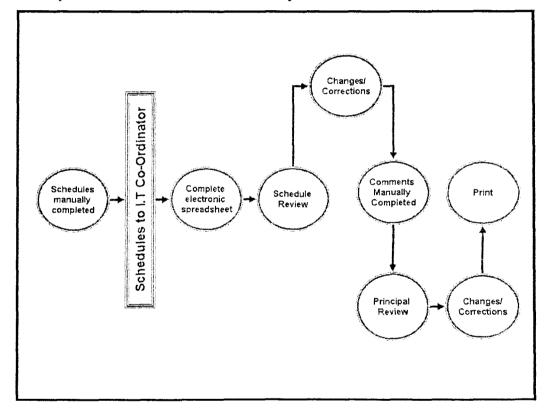


Figure 2.5 Annual Schedules

2.8 CONCLUSION

By having the appropriate ICT infrastructure in place, is not indicative of a technologically advanced institution. The key role players, in this instance the educators and administrative staff; have to be computer literate to optimally use this innovation to improve the efficiency of administrative processes and the

quality of education provided at the HCSS. In an attempt to achieve this, a conceptual model will be formulated to mitigate the research problem. In chapter 3, a literature review will be conducted on the subject of ICT and its role in the schooling system.

CHAPTER 3: ICT AND ITS ROLE IN THE SCHOOLING SYSTEM: A LITERATURE REVIEW

3.1 THE CONCEPT OF INFORMATION COMMUNICATION TECHNOLOGY

ICT is transforming the schooling systems world wide. The Ministry of Works, Housing and Communication - Uganda (2002:Online), states that ICT can be broadly defined as technologies that provide an enabling environment for physical infrastructure and services development of applications for generation, transmission, processing, storing and disseminating information in all forms. These forms include voice, text, data, graphics and video. ICT has a pivotal role to fulfil in any country's development and Uganda as such has, "recognized the potential and enabling element of information and communication technologies as a tool for social and economic development" (Ministry of Works, Housing and Communication - Uganda 2002:Online).

Kennewell, Parkinson and Tanner (2008:Online), is of the opinion that fostering the appropriate ICT environment does not merely mean having the necessary infrastructure in place, but having the necessary ICT knowledge and ICT awareness. These skills together with the appropriate infrastructure and ICT plan are considered prerequisites prior to the implementation and application of ICT in education. ICT capabilities require technical knowledge and skills as well as awareness of this knowledge base, so that effective decisions can be made. (Kennewell *et al.*, 2008:Online). Furthermore, according to the authors, ICT capability progression includes the following two major groups of factors:

- > Strategies, processes and personal qualities relating to ICT application to the solution of problems.
- The second group depends on the range of problem contexts, sources and tools applied.

According to the Department for Education and Skills (2004:Online), "ICT capability involves technical and cognitive proficiency to access, use, develop,

create and communicate information appropriately, using ICT tools". This capability is emphasized by learners applying technology decisively in order to solve problems, analyse and exchange information, formulate ideas, construct models and control devices (Department for Education and Skills 2004:Online). Furthermore, according to the Department for Education and Skills (2004:Online), "ICT capability is much broader than acquiring a set of technical competencies in software applications, although clearly these are important. ICT capability involves the appropriate selection, use and evaluation of ICT. In essence, pupils need to know what ICT is available, when to use it and why it is appropriate for the task".

Kent County Council (2004: Online) states that, "Information and communications technologies (ICT) are the computing and communications facilities and features that variously support teaching, learning and a range of activities in education" These ICT-related activities according to Kent County Council (2004: Online), include the use of the following:

- ➤ Broadcast material or CD-ROM as sources of information in history.
- > Micro-computers with appropriate keyboards and other devices to teach literacy and writing.
- > Keyboards, effects and sequencers in music teaching.
- Devices to facilitate communication for pupils with special needs.
- > Electronic toys to develop spatial awareness and psycho-motor control.
- Email to support collaborative writing and sharing of resources.
- > Video-conferencing to support the teaching of modern foreign languages.
- > Internet-based research to support geographical enquiry.
- > Integrated Learning Systems (ILS) to teach basic numeracy.
- Communications technology to exchange administrative and assessment data.

The focus is on the subject being taught or studied, or the organisation being administered, rather than developing pupils' skills with, and knowledge of, the technologies themselves" (Kent County Council, 2004: Online).

Janssens-Bevernage, Cornille and Mwaniki (2008:**O**nline) citing Plomp, Brummelhuis, & Pelgrum (1997), suggest that the use of ICTs as part of the learning process be subdivided into the following three categories:

- Object: Refers to learning about ICTs as specific courses such as 'computer education'. Learners familiarise themselves with hardware and software including packages such as Microsoft Word, Microsoft Excel, and others. The aim is computer literacy.
- Aspect: Refers to applications of ICTs in education similar to what applies in industry. The use of ICTs in education, such as in computer-aided design and computer-aided manufacturing, serves as examples.
- > ICTs are considered as a medium whenever they are used to support teaching and learning.

3.2 ICT DEFINED

According to Elston (2007:**O**nline), ICT can be defined as, 'the technology used to manage information and aid communication'. According to Kandiri (2008:**O**nline), ICT is a combination of microelectronics, computing and telecommunications. Modern trends in micro-processors and semiconductors has enabled the processing and storage of large amounts of data while integration of fiber optics and fast Ethernet technology in networks, have facilitated rapid distribution of information through communication networks.

3.3 THE IMPORTANCE OF ICT

The Ministry of Works, Housing and Communication - Uganda (2002:**O**nline), emphasized the following aspects of ICT in their National ICT policy:

- ➤ ICT has a very broad range of applications that span across various sectors of health, education, agriculture, government and commerce.
- > ICT enhances economic growth by availing enhanced competitiveness, increased trade and investment.
- Creation of opportunities and empowerment by provision of access to local and global markets and promotion of rural development.
- > Improved delivery of social services and reduction of vulnerability to natural

disasters as well as reducing isolation of communities and providing immediate linkage to the modern world.

- > Improved transparency and governance through availability of public domain.
- Introduction of new management and control methods in both public and private sectors, thus facilitating enterprise resource management.
- Introduction to the new knowledge-based economy.
- Modernization of private sector through improved market access, sales, trade and knowledge of business trends.
- > Facilitation of research and development.

3.4 THE IMPACT OF ICT ON SCHOOLS

Integrating ICT into schools could potentially lead to improving internal processes, which in turn could lead to a better quality in education. "Information and communication technologies (ICTs) have the potential to enhance access, quality, and effectiveness in education in general and to enable the development of more and better teachers in Africa in particular" (Janssens-Bevernage *et al.*, 2008:**O**nline).

Used correctly, ICT can enhance teaching methods and more importantly, learning. Learners find the use of technology to be stimulating as opposed to the ordinary teaching methods. Through the use of ICT, the quality of education could be greatly improved and be more enticing for learners. According to Anonymous 1, (2008:Online), "ICT can be used to improve students' motivation and active involvement in learning processes. Possible applications would include gaming/simulations, self-assessments, peer assessments, streaming video, and social software. This is where ICT serves as a student motivator, implementing innovations in teaching methodology to make education more attractive and to improve the quality of education that way. Another version of the motivator variety is distance learning, decreasing lecturers' and students dependence on place and time constraints. This would expand the scope of education beyond campus boundaries".

A review of the impact of ICT on schools in Europe, Balanskat, Blamire and Kefala (2006:Online), concluded that there is an increasing gap between high and low 'e-confident' teachers. The same applies to schools where ICT is used effectively and efficiently, the benefits are apparent. 'This 'tipping point' implies that there is a period when results do not seem to justify the investment, and then suddenly everything takes off and added value is considerable' (Balanskat *et al.*, 2006:Online).

A study conducted by Balanskat *et al.* (2006:**O**nline) concluded that, "pupils, teachers and parents consider that ICT has a positive impact on pupils' learning". In an attempt to determine whether ICT improves learner performance, two in three educators reported that the improvement in their learners' subject-related performance and their basic skills are evident. "In addition, teachers consider that academically strong students benefit more from ICT use. Only the Finnish teachers' experiences are less positive and many think that ICT has no impact" (Balanskat *et al.*, 2006:**O**nline).

Ideally, ICT training should form part of the teachers qualification offered by tertiary institutions. Educators who have long graduated and obtained the qualification, should be sent for ICT training, perhaps even make the training mandatory. This program would not only cover computer literacy, but also how to use ICT to make ordinary lessons more attractive to learners, as well as how to use ICT optimally for completing administrative tasks. By empowering educators to this degree means that the traditional classroom teaching methods could be transformed into a new technological dynamic, geared toward enhanced learning and teaching. Kozma (2008: Online), is of the opinion that many governments use the introduction of ICT as a way of providing teachers with new skills as well as introducing new pedagogy into the classroom. Kozma (2008:Online) citing Pelgrum & Anderson (1999), states that a survey conducted in 26 countries and case studies conducted by Kozma (2008:Online) in 27 countries, clearly indicate that the use of ICT has often been thought to bring significant changes into classroom practice. Innovative, constructive use of computers does not only depend on the availability of the technological infrastructure, but on other factors such as educator training, administrative issues and the appropriate policies and procedures being in place.

In a study conducted on Scottish schools by HM Inspectors of Education (2005:Online), it was found that the majority of educators thought that the main advantage of integrating ICT into the learning process was its potential to motivate learners and in turn raise their achievement. "Some teachers made particular mention of its positive impact on the level of engagement of boys, in that it usually involved a hands-on experience and active involvement in the learning task. It gave many pupils the opportunity to learn in a greater variety of ways, better matched to appropriate learning styles. For example, a science concept could be presented visually through 3D diagrams or animation. A pupil studying a modern language could see, hear, or interact with a native speaker or repeat a segment of language until it was understood. The study also concluded that many pupils enriched their learning experience by using ICT in a range of ways across their learning and across the curriculum" (HM Inspectors of Education 2005:Online).

In both primary and secondary, according to HM Inspectors of Education (2005:Online) the use of ICT allowed pupils to:

- > Be more individually and actively involved in the learning process.
- Be more independent in their learning and make more choices about how and what they learn.
- > Be able to interact with their learning resources.
- Move at an appropriate pace in their learning.
- Be challenged in their learning activities.
- Consolidate their learning on an individual basis.
- ➤ Be more creative in the way that they respond to the learning process.

According to Kozma (2008:**O**nline), studies have determined that computers can have a positive effect on student motivation. Kozma (2008:**O**nline) citing Blackmore *et al.* (2003), believes in the Western research literature there is consistent evidence that when given access to computers in the context of student-centered pedagogy, students with disabilities, indigenous students, and students

from low income homes all experience growth in their sense of self esteem and autonomy in their learning.

HM Inspectors of Education (2005:Online), determined that in most primary schools included in the study, the use of ICT had enhanced the quality of teaching and improved pupils' motivation. In the best practice, teachers incorporated ICT into their plans across the curriculum. Progression in the development of pupils' ICT skills across the stages was evident. Such practice was predominantly linked to the effective timetabling of facilities, making flexible use of machines in classrooms and/or in a computer suite.

Balanskat *et al.* (2006:**O**nline), concluded that ICT integration into teaching and learning improves attainment. The study determined that there is a certain amount of difficulty to measure the extent of the improvement or the common factors connecting e-learning to improved results. "Inferring a causal relationship between ICT and pupil achievements from simple correlations can be misleading. It has to be considered that many unobserved factors may influence better learning results in national tests" (Balanskat *et al.*, 2006:**O**nline).

The study 'Innovative Learning Environments for School' (Balanskat *et al.* 2006: **O**nline), concluded that ICT is not the sole influence on a learning environment. A paradigm shift in learning may be influenced by the strategic use of ICT combined with factors such as local school strategies, the school management's style, and parents' attitude. "It can be assumed, that schools with more motivated teachers and head teachers are more likely to adopt ICT and to produce better attainment" (Balanskat *et al.*, 2006:**O**nline). The findings may be misleading should these factors not be considered. "Isolating the impact of just one factor, such as ICT, therefore requires a well-considered approach" (Balanskat *et al.*, 2006:**O**nline).

Research and evaluation at the Kenya Technical Teachers College indicated that exposure to ICTs positively affected the lives of lecturers and students alike. Students described the changes in their learning environment according to Janssens-Bevernage *et al.* (2008:Online) citing Janssens-Bevernage (2002), as follows:

- Learners have become more independent and no longer consider the lecturers as the sole sources of knowledge.
- > Students increasingly enjoy learning.
- > Students welcome the classroom level democratisation process taking place.
- They consider their lecturers as students themselves.
- Students have started using ICT facilities optimally and no longer have to spend a considerable amount of time and money running around libraries to look for information.
- They are better able to assess educational practices and policies.
- They are proud of being part of ICT because the college is viewed by outsiders as innovative.
- Students relate with others as they undertake research activities together and assist each other.

John (2008: Online) citing Gregoire, Bracewell & Lafarrier (1996), provides the following in terms of student learning, in their analysis of the contribution new technologies can make to teaching:

- New technologies can stimulate the development of intellectual abilities.
- It can contribute to the ways of acquiring knowledge, skills and attitude, even though this depends on previously acquired knowledge and the type of learning activity.
- > New technologies encourage spontaneous interest.
- > Students utilizing new technologies concentrate more as opposed to students using traditional settings.

3.5 ICT IMPLEMENTATION

An implementation of any sort is entirely dependent on how accurate the information gathering stage was. The information gathering stage encompasses a needs assessments and cost-benefit analysis among others. Sevilla and Shabaya (2007:10), states that successful implementation of an Information System requires that one gathers detailed and accurate requirements. These requirements will help determine the level of quality in the system in line with Deming's definition of quality (Omachonu & Ross, 2004:7).

A case study based on ICT and school improvement conducted by Mioduser, Nachmias, Forkosh, Tubin, Cohen, Gertman, Tzatzashvili, Yaron, and Oshri (2001:Online), returned that the use of innovative technology enhances the teachers motivation to teach. Students of different abilities benefit by expanding their ICT knowledge and honing their ICT skills. They also appear to become more interested in learning. Students with special needs are also able to study in an innovative manner, more suited to their pace.

According Nachmias. Mioduser. Cohen. Tubin. Forskosh-Baruch (2004: Online) citing Venezky and Davis (2001), the swift and insidious implementation of new ICTs in the education system raises expectations with regard to not only it's potential for the improvement of education, but also for the contribution to the improvement of education. Regardless of the accelerated implementation of ICT infrastructure in the educational system, this is only the beginning of a long process. The study conducted at ten Israeli Schools found that not all of the factors involved in an innovation affect it evenly. The most important combination is a history of innovation backed by encouraging local ICT policy, combined with three main leading forces namely the principal, leading staff and the ICT coordinator (Nachmias et al., 2004: Online).

According to Anonymous 2 (2008: **O**nline), ICT encompasses the following three factors, which are fundamental to the information society:

- > Automation suggests that processes can be divided into separate tasks that can be translated into computer software.
- > Informatisation implies that not only can technology process information, but it can also produce new information. This makes it possible to establish an overview of processes and development trends.
- Internal and external communication networks via ICT is also possible.

Anonymous 2 (2008: **O**nline), is also of the opinion that employees involved must partake in closer collaboration with the internal and external business environment. They must be able to maintain an overview of both internal and external organizational processes of a company.

Yuen (2008:Online) citing Kearsley (1990), is of the belief that a technological adoption model highlights managing technological infrastructure, organisational structure and teachers' technical skills. Furthermore, in schools where this model is used, expository and resource-based arising from approaches that are most commonly found in pedagogical practices. The role of the teacher is considered as someone who presents information and evaluates performance, while the functions of ICT are to enhance the effectiveness of information presentation and to stimulate students' learning interest. Yuen (2008: Online), describes technology as an alternate when monitoring and providing feedback to students with regards to assignments and exercises. This in turn relieves the teacher of tedious, repetitive tasks. An important function of teachers in this technologically geared phase is to generate sound ICT based learning resources.

Mioduser *et al.* (2001:**O**nline), claims that the successful implementation of ICT depends on the educators, ICT academic value, student ICT competence and technology infrastructure.

3.6 THE APPLICATION OF ICT IN SCHOOLS

Much as the implementation phase is dependent on certain factors in the information gathering phase with the application phase being dependent on the implementation phase. A suitably implemented ICT infrastructure combined with the necessary skills set and appropriate strategy, is geared toward improvement in terms of enhancing learner experience as well as educator abilities.

Becta (2006:Online), claims that reaching and maintaining sustainability represents an important aspect in terms the factors involved in developing ICT to foster school improvement as well as pupil learning. There is an indication that the use of Total Cost of Ownership (TCO) analysis can make a considerable contribution to achieving the objective. Before an organization can implement a sustainable ICT innovation or system, an adequate and efficient review of the existing system must be conducted. For learners to fully benefit from ICT-enhanced learning and teaching, this systematic review must cover all aspects of

the Becta TCO model. More specifically, the following factors according to Becta (2006:**O**nline) need to be addressed:

- Assess the quality of facilities and services required by the ICT development plan.
- ➤ Audit existing ICT equipment age and costs.
- Identify the impact of existing ICT and practices on staff (and possibly pupil) satisfaction, confidence and competence.
- > Review staff training needs.
- > Compare current costs against relevant benchmarks.
- > Review purchasing practice and value-for money processes.
- > Compare actual ICT support needs against the quality and value of current technical support and compliance with FITS.
 - ➤ Reassess the quality of facilities and services needed to support the ICT development plan in the light of these reviews (points 2–7).
 - Plan and introduce a rolling three-year whole school budget, allocating a realistic proportion to ICT.

Briscoe and Lee (2005:Online), believes that school leaders need to have a general idea of the ICT provision throughout their school. They should be able to identify and understand good ICT prerequisites and where they are in relation to it. Once this self review period has been concluded, it is crucial to the strategic development of ICT to establish a vision of where they wish to go.

Having merely an ICT infrastructure and relevant knowledge, does not constitute an ICT plan. In order for any innovation to be potentially successful, a vision must be in place. This particular vision should be carefully articulated and circulated among employees, with understanding and acceptance. Daly (2001:Online) citing Byrom (1998), state that the need for a detailed plan for professional development has to be identified as one of the prime necessities for success in educational technology projects.

According to Ntetha (2005:**O**nline), the three key elements in successfully implementing a technology plan for a school are:

- > Appropriate hardware and software,
- > computer-literate staff, and a

> technology curriculum.

For this particular model to be successful, all three the above mentioned factors must be taken into consideration and must be implemented. Should any one of these be omitted, the full technological capability would be compromised.

According to Paul (1999:Online), many schools that have an infrastructure and equipment conducive to computer usage/learning, are still using conventional teaching methods. Many of these schools do not have a plan or a set of guidelines to follow with regards to implementing the beneficial use of computers in a school. The author also highlights that although children at schools do have computer lessons, they have a limited level of access to computers as well as what is being taught during these lessons. The problem areas that the author has highlighted (pertaining to schools in Eastern Cape), are the shortage of equipment, poor placement of existing resources, lack of knowledge and lack of a carefully developed plan for the use of technology.

An initiative by the Western Cape Education Department (WCED) has been launched in the form of the Khanya project (Benting, 2006:Interview), to endeavour to meet the needs of educational technology for educational use at schools in the Western Cape. According to (Benting, 2006:Interview), there are 1570 public schools in the province of which 575 have educational technological facilities available to them.

Sevilla and Shabaya (2007:10) are of the opinion that the formulation of a strategic plan that renders a clear vision and mission of areas to be automated, is essential to ICT integration.

As with any change process, there are obstacles that need to be overcome. Thorburn (2004:Online), states that along with educational change there are many obstacles that may cause any innovation to be less than considerably realised. Technological change is no different. One of the most alarming issues is that the same barriers have existed for a very long time without much organizational success in overcoming them.

"When ICT enters the school environment, everything in the environment has to change to take up the opportunities and address the limitations of ICT" (Ping 2008:Online). Ping furthermore is of the opinion that in order to further enhance the potential of ICT, a shift in pedagogy should occur, the curriculum and assessment should be redesigned, and a more autonomous environment for schools should be established.

Yuen, Law and Wong (2003:Online) citing Fullan (1992), identified three dimensions of change regarding the teacher using computers in the classroom namely:

- > The use of new hardware and software materials;
- > The adoption of new activities, behaviors or practices; and
- > Changes in beliefs and understanding.

Yuen, Law and Wong (2003:Online) citing Fullan (1992), emphasized that a considerable amount of thought should go into the change process. The key factors associated with the implementation of computers in classrooms should be effectively managed. These factors include characteristics of the innovation, commitment and support, professional development, and leadership of the principal.

Yuen (2008:Online) citing Fullan (1982), believes that any change can be examined in terms of the difficulty involved, skills required, the extent of necessary alterations in beliefs, and the use of materials.

"Research on educational change has been going on for decades. Many studies were conducted in the U.S. as early as the 1930's and many more studies were done over the following twenty year period" (Thorburn 2004:**O**nline). (Thorburn (2004:**O**nline) citing Mort (1996), goes on to say that some of the most interesting findings from these early studies were as follows:

- The time between innovation and institutionalization takes decades, although there is a surge in the system when many schools adopt at the same time.
- Schools vary greatly in both their willingness or ability to adopt new practices.

> Interest groups both inside and outside of the school are critical elements in the adoption process.

According to Ping (2008:Online), an ICT innovation launched by the Ministry of Education in Singapore identified four main goals as the blueprint for this innovation known as Master Plan 1, namely:

- Expanding and enriching the learning environment by enhancing linkages between the school and the world around it.
- Encouraging creative thinking, lifelong learning and social responsibility.
- > Generating innovative processes in education.
- > Promoting administrative and management excellence in the education system.

3.7 COMPUTER LITERACY VERSUS CONVENTIONAL TEACHING METHODS

"The idea that 'new forms of learning' associated with ICT might conflict with older forms is particularly pertinent to early childhood education where debate surrounding the nature of the curriculum has been particularly intense" (Cook 2008:Online). Computer literacy is the knowledge and ability a person has to use computers and technology efficiently. Eisenberg and Johnson (2002:Online), are of the opinion that there is an increasing consensus that computer literacy means being able to use technology for communication, organization, research and problem solving. According to the authors, this is a vital shift in approach and emphasis.

"ICT Literacy – the demonstration of learning skills through the use of 21st century tools – is critical to student success in school and in the 21st century workplace. When thinking about how to evaluate the demonstration of ICT literacy, there are numerous examples where business and industry have successfully integrated technology into subject mastery" (Anonymous 3 2004: Online, citing Magner 2004).

Without the application of pedagogical change, educators are still using traditional teaching methods combined with new ICT tools. (Chung 2005:Online citing Trinidad, 2005). A briefing paper prepared by PJB Associates (2008:Online), concludes the following:

- Dynamic learning environments can be stimulated by innovative use of ICT in teaching/learning.
- Successful integration into existing educational activities forms the crux of the effectiveness of ICT based innovations, scientific knowledge and/or new educational/pedagogic models.
- A working definition of ICT-related teaching/learning should focus on the activities of innovators who are integrating into existing activities or new activities, resulting in profound changes, reforms or improvements in teaching learning processes and outcomes. This includes existing or new: -
 - > ICT-based teaching/learning products.
 - ICT-related educational/pedagogic theories and scientific research outcomes.
 - > ICT-related institutional/organisational strategies and plans.
- > Teachers are the central figures for the acquisition of knowledge, emotional and social development of their pupils in ICT-related learning, but this role has been altered by new models and the use of ICT.
- The distribution of roles/responsibilities and classroom interaction has been affected by the implementation of ICT in school teaching/learning.
- Schools still produce ICT teaching/learning innovations regardless of their differing learning patrimonies and characteristics...
- There are two main approaches for the conduct of ICT teaching/learning innovation. The first uses real life experiences and practice innovative ideas. This can be fully integrated into the whole school's development plans. The second enables the teachers involved in the research and development to support and initiate educational innovations, which can enhance research through:-
 - Contributions to the design and methodology of research projects.

- > Tailoring situations for learning and research that are better suited to schools.
- > Expanding the anticipated uses of ICTs in education.
- Insights into the strengths, limitations and suitability of research outputs in schools.
- Localising the research outputs.
- Disseminating results of the research to colleagues and throughout schools.
- Many of the projects were less successful as they had very few teachers involved in their implementation stage, and there was not 'whole school' involvement in the design and evaluation stages. Also, teacher's language barriers' and heavy workloads affected the sharing of informal knowledge.
- The sustainability of research and development driven innovations is threatened by:
 - > The nature of research knowledge and practices.
 - > Schools' attitudes towards research and development.
 - > The links between researchers and schools.
 - The time spans of the projects.
 - The nature of research and development products.
- > The methods of reporting research limits the dissemination of new knowledge amongst school practitioners, as these methods are not considered important sources for teachers' professional development.
- The acceptance of ICT-related teaching/learning innovations relies on regular access for teachers and pupils to up-to-date networked ICT.

ICT integration is not only geared toward dynamically improving learning and teaching. A case study conducted at Banghwa Elementary School (Song, Lee, Jang, Ahn 2001: Online), determined that not only did ICT integration improve the teaching-learning environment, but it has also rendered other educational effects such as the digitalization, development, and application of the student records database in counseling.

Forster, Dawson, Reid (2005:Online), identified three other principles that describes the design of the curriculum with regards to the use of ICT. The first was that learning how to use technology for technology's sake is not productive. Furthermore, technology should make available knowledge or content that enhances students' learning (Forster *et al.*, 2005:Online citing Learnison, 2001). The second was that tertiary educators need to help teachers develop a clear vision with regards to how they can facilitate student learning with computers (Forster *et al.*, 2005:Online citing Wang, 2002). The third being one of the ways a clear vision can be formed is by modelling appropriate ICT skills in tertiary education: "as preservice teachers see technology modelled and as they are provided with more opportunities to use technology in the classroom setting, high anxiety levels stemming from negative attitudes toward computers will be lessened" (Forster *et al.*2005:Online citing Pope, Hare & Howard, 2002).

Jager and Lokman (1999:Online), is of the opinion that a teacher requires many educational and didactical skills to deal with questions adequately. It concerns matters in the likes of:

- A great pedagogical, didactical an educational psychological craftsmanship.
- > To be a professional on the subject matter.
- A large knowledge of modern educational tools.

3.8 INTEGRATING COMPUTERS INTO THE CURRICULUM

The integration of ICT into the existing curriculum should be viewed as a pivotal factor in the success of such an innovation. According to Monteith (2008:Online), teachers should be able to assess their level of ICT competency in order to encourage learning change. Monteith (2007:Online), suggests that the use of ICT should reveal the effects of policies and behaviour.

"In the education sector, curriculum review efforts are geared towards modernisation, including the incorporation of important ICT components. However, even the reviewed curricula tend to treat ICT as a subject rather than as an application tool that can be used in all other subjects, in teaching and learning. Very recent discourse indicates that future curriculum reviews may consider a

fully fledged ICT mainstreaming process" (Janssens-Bevernage *et al.*2008:**O**nline).

Incorporating ICT with the education curriculum could potentially lead to an enhanced learning and teaching experience. "The intention of the National Curriculum is also to reflect the higher order skills of planning to use ICT, making decisions concerning appropriate resources and techniques, monitoring progress and evaluating outcomes" (Kennewell *et al.*, 2000: **O**nline). They go on to say that using ICT throughout the curriculum should encourage "critical thinking, imagination and creativity, problem solving, initiative and independence, teamwork and reflection" (Kennewell *et al.*, 2000: **O**nline citing QCA, 1998).

Ping (2008:**O**nline), found that locally developing ICT-based resources is important to support the curriculum, as it increases the relevance and enhances the authenticity of the resources for the students and teachers.

A case study conducted at Hjortespring Skole reached a consensus that ICT is an important area of skill which learners have to be taught. Technology is considered a means for obtaining teaching objectives and not an objective itself. The use of ICT in teaching depends on the individual teacher's competencies and attitude to ICT (Carlson, Broe, Drewsen, Spenceley 2000:Online). "Teachers are the key to the successful integration of ICT into education. They manage the processes of teaching and learning. Without the active, enthusiastic and skilled participation of teachers, innovations to enrich education with the advantages offered by technology, are doomed to fail. The full participation of teachers in adopting new technologies to enhance education requires a commitment to ongoing professional development of teachers" (Kader, 2008:Online).

In the study of ICT integration (Soule 2003:Online), reviews the processes of where, why and how computers can be used to enhance teaching and learning experiences. One of Soules' findings are that nurturing an intellectually curious learner should be the aim of technologies used at schools. Cuban (2001:34), reports that teachers tend to use computers predominantly for administrative work. In instances where technology is used by teachers, they convert these technologies

to conform to traditional teaching methods, and subsequently do not cultivate new methods of teaching.

Cohen, Tzatzashvili, Yaron, Oshri and Gertman (2001:Online), state that at Cramim school in Israel, ICT supported the high academic standards of the teachers and the school. It was highlighted that ICT can bring about lowering of academic standards. Factors attributing to this includes, waste of time and surfing the web. This is overcome to a degree by educators directing students exactly and in accordance with educational goals.

Teaching learners how to use word processing packages and to search for information using the Internet, does not constitute computer literacy. Eisenberg and Johnson (2002:Online), refers to this as the 'laundry list', combined with curriculum integration, "it sets us in the right direction on our quest to achieve computer literacy". Eisenberg and Johnson (2002:Online), is further of the opinion that while it is important for a learner to gain these skills, this approach does not provide an adequate model for students to apply their skills from situation to situation. It is therefore imperative that ICT is integrated into the curriculum so that learners are taught how to use technology to their benefit.

The National Council for Curriculum and Assessment and ICT in Ireland formed a committee tasked with examining issues resulting from ICT integration. This group determined that the NCCA established a set of guidelines for teachers as well as a steering committee who would be responsible for ICT policy and provision in schools. This particular steering committee according to O'Grady (2007:12-13), suggested that the following principles form the basis of the NCCA's work:

- > ICT should be used actively by learners from junior infants onwards;
- ➤ all learners should use ICT in relevant curriculum contexts;
- by the end of compulsory education all students should have achieved a
- > defined level of ICT competence.

Korte and Hüsing (2007:3), conducted a European study that concluded that only a small number of teachers oppose ICT integration. Of these teachers who do not

use computers in class (16%), are of the opinion that the use of ICT yields 'no or unclear benefits'. In total, this amounts to only 4% of European teachers. This is true especially for the more experienced teachers, whereas the younger educator appears to be 'less skeptical about the positive benefits of ICT in learning'.

Bekkers, Head Mistress at HCSS, believes that children should be exposed and kept up to date with the ever changing world of technology (Bekkers, 2006:Interview). Bekkers believes that exposure at primary school is a vital part of preparing children for the modern life we live in today.

Loveless (2008:Online) states that ICT can be used to demonstrate and develop cognitive skills and mental structures of a child. "Approaches to problem solving and the expression of ideas can be explored using resources such as multimedia applications, programmable toys and programming languages" (Loveless, 2008:Online). "ICT changes rapidly and new innovations offer new possibilities for teaching and learning. These not only open up new techniques to influence the existing curriculum more effectively or more efficiently, but changes the nature of that curriculum by altering the content of what needs to be taught, such as in the area of digital literacy with the use of electronic texts or the progression of how a topic like algebra can best be taught" (Higgins 2008:Online).

3.9 ESTABLISHING ICT CONFIDENCE IN STAFF MEMBERS

ICT users need to feel comfortable and confident before they can incorporate it into their daily tasks and lessons. It should come as second nature to them and not as something out of the ordinary. Kader (2008:Online), is of the opinion that any ICT in education professional development programme, there are three aspects that should be considered. Firstly educators need to gain the knowledge and judgement to select and evaluate ICT resources that are suitable for teaching and learning in their own subjects. Secondly, teachers need to be able to properly assess when and how to integrate ICT into their lessons. Kader says that many aspects of education can be enhanced with the prudent use of technology. A teacher needs to be able to distinguish between these, and finer, distinctions. Thirdly, teachers need to able to evaluate the effects of ICT on their teaching and

on their student learning. If the curriculum is defined in terms of learning outcomes, and standards for ICT-enriched teaching and learning are clearly defined in measurable terms, then the teacher would be able to apply the outcome measures, both to their own teaching and to student results.

According to Sevilla and Shabaya (2007:10), involving users at all levels reduces the risk of system rejection or failure. Change management procedures are vitally important to allow for a shared perception of the change from all stakeholders. They also go on to say that top management involvement, especially in areas of approval of funds and management, is very important.

In a case study conducted at Cramim School (Cohen et al., 2001:Online), it was determined that the evidence gathered at Cramim supports the argument that successful implementation of ICT depends mainly on staff capability to absorb ICT in the teaching and the learning processes. "Students were led by their teachers in an effort to improve their ICT skills, fostering wise usage of technology in pedagogical practices."

According to Regan, Robertson, McKenzie (2003:Online), the Anderson's Creek Primary School in Australia believes that their program or model reflects their philosophy that children should be in control of the technology, and not merely respond to 'educational game' software packages. The integration and development of ICT skills enhances and enriches the curriculum. These skills are taught within the Key Learning Areas

The teaching staff at Andersons' Creek Primary is also subjected to technology development and integration (Regan *et al.*, 2003:**O**nline). Teams, with one ICT skilled person, are established based on the talents and strengths of each staff member. Teams then follow a team program and are able to use the ICT skilled person as a mentor who is able to provide advice, support and skill development at weekly meetings. Anderson Creek Primary School nurtures a computer literate staff by providing after school skills development. This is in response to a survey conducted amongst teachers. The schools aim is to equip all staff members with the necessary skills and equipment to facilitate ICT integration.

Teachers should start using technology when they feel comfortable to. As soon as they master one particular task, they should look at how they can add value in the classroom. This pertains to integrating IT in the classroom and in an administrative manner. According to O' Grady (2007:19), teachers from Ireland who participated in this study displayed a lack of practical experience with regard to using ICT in the classroom. It was suggested that a more positive environment be established to promote ICT use. Furthermore, student teachers should be placed with ICT-literate teachers for the duration of their practice teaching. It was also determined that by gaining confidence and experience in using technology, proved to be valuable in gaining employment.

A holistic, structured approach to the development of teachers' professional ICT capability through a consideration of their attributes is arguably more likely to provide the structure that will lead to the changes in pedagogy and school reform that many have argued that the use of ICT should be coupled with (Trinidad, Newhouse and Clarkson 2008:Online).

A study conducted by Gronn (2007: Online), explored the possibility of teachers aspiring to be more confident and skilful with ICT in their classrooms, by relying on the knowledge and skills of children to mentor them in their learning of ICT. Gronn concluded that this study has allowed teachers and learners to let go of the false assumption that educators are the holders of all knowledge. This has in turn enabled them to work together to develop the teachers' ICT confidence, skills and knowledge so therefore to improve the use of ICT in their classrooms.

3.10 ICT TRAINING

The provision of the necessary training to all educators and administrative staff is as important as the implementation and application phase of any innovation. "The application of ICT can only be successful if the relevant role players are provided with a working level of training so as to optimally use the ICT capabilities" (Zammit 2008:Online). Having the appropriate technological infrastructure in place is only a step toward achieving ICT literacy. "Technology is futile without

the humans behind it, before teachers embrace technology and realise its true potential, the next steps cannot be taken. Teacher training is the key to this development" (Zammit 2008:Online).

Jung (2005: Online), is of the opinion that not only can ICT facilitate the learning process, but there has also been evidence that ICT may provide more flexible and effective ways for life long professional development for educators. Research concluded that ICT can alter the way educators teach and it is especially useful in supporting student-centred approaches to instruction, as well as developing the higher order skills and promoting collaborative activities (Jung 2005: Online citing Haddad 2003). Furthermore, Jung states that most countries have provided ICT educator training in various forms and although educators may report that they have not received adequate training to use technology effectively, there is evidence of various countries that are using technology effectively to train educators as well as empowering them to use technology as tools for enhancing teaching and learning.

PJB Associates (2008:Online), believes that ICT-related teaching models that encourage both pupils and teachers to play an active role in teaching/learning activities, should be supprted by teacher training and professional development oriented policies. Policy reforms for teacher training should prioritise the adoption of new teaching/professional development models and the development of practical ICT-related skills that related to:

- Collaboration.
- > Curriculum and resources management.
- Knowledge building.

The policy should encourage long-term networks between schools and research institutions/universities, as these will help support schools in becoming learning organisations. However, reform is needed of existing curricula and assessment structures. Teachers need to adopt, develop and support a pedagogic culture that develops supportive practises for pupils' and encourages own theories in teaching/learning activities. It should be linked to the development of life-long learning and professional practices that enable teachers to keep in touch with ICT developments,

new knowledge and research on teaching/learning. Further scientific research is needed into this area (PJB Associates 2008:**O**nline).

A strategic vision focused on ICT and its integration should exist and be embraced by the entire institution. Management should assume ownership in demonstrating commitment to this vision so as encourage staff members to embrace this ICT vision. Anonymous 4 (2008:Online), states that all staff, management, support and academic; need to understand the importance of ICT. They must be equipped with the appropriate knowledge and skills to enable them to use the technology effectively. Generally speaking, training is the most neglected aspect of ICT implementation. Trained teachers will impart knowledge effectively to students through their confidence and expertise by using ICT to improve their teaching. According to Schreurs (2007:Online), the ability to improve teaching, learning and achievement should be the driving factors behind the ICT vision.

Acquiring the proper skill set to demonstrate ICT integration as well as the application thereof could prove to be a daunting task as technology itself is a rather unique entity. Thorburn (2004:Online), is of the opinion that there is a skill preference associated with the desired level of change. "Computer technology will eventually become our constant companion; this is when true change will occur" (Thorburn 2004:Online citing Dwyer 2002). Thorburn continues by stating that previous large scale innovations have not had the skill bias that technology integration has. "However, for the most part, teachers, administrators and other central office personnel have had the skills to implement these changes. Of course, there was professional development for teachers and administrators, but the professional development was geared more towards a honing of the skills teachers already had, rather than the adoption of a whole new set of skills" (Thorburn 2004:Online).

According to Thorburn, by integrating technology, teachers are expected to acquire a new set of skills. Teachers need to learn how to use technology optimally in the classroom, using the technology's advantages, if technology is to reach its potential in the classroom. "This lack of skill will hinder the technology

integration effort. However, when teachers do develop the skills to the point where computer technology is 'their constant companion', then large scale change will not be far away. Online professional development can provide an excellent opportunity for teachers to acquire these skills" (Thorburn 2004:Online).

3.11 ICT MEETING ADMINISTRATIVE DEMANDS

Sevilla and Shabaya (2007:1) citing Wanyembi (2002), confirms that the academic institutions have started automating core functions. These functions include student admission process, estate management, fees payment, examination records management and library services among other functions. Anderson's Creek Primary School, Australia has successfully integrated their administrative tasks with technology by means of an intranet. Here they have all processes and procedures as well as documentation staff may need, readily available. (Regan *et al.*, 2003:**O**nline). O'Grady (2007:16), found that Irish teachers expressed concern not only about the amount of paperwork involved in their daily administrative routine but regarding accountability as well.

HM Inspectors of Education (2005: Online), in their research found that there were constructive developments in many schools' use of ICT in administration. One of the most evident was the increasing development in the secondary sector of information management systems to track and record pupil progress. In some schools, this process was directly related to target-setting, where it allowed managers, teachers and guidance staff to focus on pupil progress through individual units of work leading to national assessment. A few schools used the electronic system as a main point of reference for discussion with pupils on their progress. A number of schools were beginning to use electronic systems to record attendance.

Furthermore, HM Inspectors of Education (2005:Online), also found that in one particular school, educators used a system to basically record misbehaviour and to foster good behaviour by means of 'praise emails'. E-mails were being used as an effective means of communication among all staff. It was found that daily use of the technology encouraged greater confidence and competence in all staff.

Teachers in one primary school submitted their future planners electronically. The school had plans to extend the intranet, which at present contained a number of relevant policies, to include these future plans. A few schools had developed an effective school website, which allowed them to present key documents such as the school handbook, policies, news and other information useful to parents and others.

3.12 CONCLUSION

In conjunction with a good implementation plan and training program, successful ICT integration should streamline processes optimally. In the next chapter, the ICT confidence survey design and methodology will be expanded upon.

CHAPTER 4

ICT CONFIDENCE SURVEY DESIGN AND METHODOLOGY

4.1 THE SURVEY ENVIRONMENT

The HCSS is an independent primary school with grades R to grade seven. The

two groups of individuals who are directly affected by the integration of ICT

comprise of educators and learners. The aforementioned two groups will serve as

the research environment

4.2 AIM OF THIS CHAPTER

The aim of this chapter and the survey contained therein is to determine the

current level of ICT integration present and what steps need to be taken to

integrate ICT optimally within the HCSS. The proposed integration focuses

primarily on the training, the curriculum and administration processes. The

ultimate objective being to solve the research problem as defined in Chapter 1,

Paragraph 1.3.1, and which reads as follows:

"The poor deployment of ICT within HCSS resulting in inefficient

processes adversely impacting on the quality of education provided

and efficiency of internal processes".

CHOICE OF SAMPLING METHOD/ TARGET POPULATION. 4.3

The HCSS has two groups who are directly affected by ICT integration, each with

a unique benefit which can be derived from the innovation. The two groups,

which will serve as the individual strata for the research survey, are as follows:

> Educators, and

learners.

The school has two leaner phases, which are made up as follows:

> Senior Phase: Grade four - Grade seven.

> Junior Phase: Grade R – Grade three.

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The staff compliment is made up of three units:

- > Senior Management Team: Consists of the principal, deputy principal, Senior Phase Head of Department and the Junior Phase Head of Department.
- **Educator Team**: Consists of the entire compliment of educators, aftercare facilitators, remedial staff and the principal.
- Administrative Team: Consists of the secretary and bursar.

The data collection methodology used in the survey, falls within the context of a survey, defined by Collis & Hussey (2003:60), as: "A sample of subjects being drawn from a population and studied to make inferences about the population". Furthermore, according to Collis and Hussey (2003:155-160), a sample is made up of some of the members of a 'population' (the target population), the latter referring to a body of people or to any other collection of items under consideration for the purpose of research. The 'sampling frame' according to Vogt (1993:4) represents a list or record of the population from which all the sampling units are drawn. The target population forming the sampling frame consists of 485 learners and 30 educators from the HCSS. The sample randomly drawn consists of 80 learners, (10 from each grade) and 20 educators.

The target population was specifically chosen in order to validate the practicality of the concepts as presented here. The risk of bias, which cannot be statistically eliminated, is recognised by the author, based on the very definition of the target population as well as the number of respondents selected.

4.4 DATA COLLECTION

Three data collection methodologies will be deployed in the execution of this research study, namely a questionnaire, participant observation and focus group.

According to Emory and Cooper (1995:278), three primary types of data collection (survey) methods can be distinguished namely:

- Personal interviewing.
- Telephone interviewing.

Self-administered questionnaires/surveys.

The primary data collection method used in this survey are self-administered questionnaires/surveys.

Remenyi *et al.* (2002), cited by Watkins (2008:54), define the concept of 'survey' as: "...the collection of a large quantity of evidence usually numeric, or evidence that will be converted to numbers, normally by means of a questionnaire", while Gay and Diebl (1992:238), defines the concept as an attempt to collect data from members of a population in order to determine the current status of that population with respect to one or more variables.

Kerlinger (1986:372), define 'field study' as non-experimental scientific inquiries aimed at discovering the relations and interactions among ... variables in real ... structures. As in the case of most academic research, the collection of data forms an important part of the overall dissertation content.

4.5 MEASUREMENT SCALES

The survey will be based on the well-known Lickert scale, whereby respondents were asked to respond to questions or statements (Parasuraman 1991:410). The reason for choosing the Lickert scale, the fact that the scale can be used in both respondent-centred (how responses differ between people) and stimulus-centred (how responses differ between various stimuli) studies, most appropriate to glean data in support of the research problem in question (Emory and Cooper 1995:180-181). The advantages in using the popular Lickert scale according to Emory and Cooper (1995:180-181) are:

- Easy and quick to construct.
- Each item meets an empirical test for discriminating ability.
- The Lickert scale is probably more reliable than the Thurston scale, and it provides a greater volume of data than the Thurston differential scale.
- The Lickert scale is also treated as an interval scale.

According to Remenyi, Money & Twite (1995:224), interval scales facilitate meaningful statistics when calculating means, standard deviation and Pearson correlation coefficients.

4.6 THE DEMAND FOR A QUALITATIVE RESEARCH STRATEGY

While this author acknowledges that a number of strategies can be applied in similar research projects, the well-known concepts of objectivity, reliability etcetera, inherited from the empirical analytical paradigm, is suggested for business research in more or less the traditional way. Quoting Thorndike & Hagen, these concepts are defined by Emory & Cooper (1995:156), as follows:

- **Practicality:** Practicality is concerned with a wide range of factors of economy, convenience, and interpretability.
- ➤ Validity: Validity refers to the extent to which a test measures what we actually wish to measure. Yin (2003:34), identifies 3 subsets to the concept validity, namely: Construct validity, internal validity and external validity.
- > Reliability: Reliability has to do with the accuracy and precision of a measurement procedure.

4.7 SURVEY SENSITIVITY

Research conducted in areas of a sensitive nature as in the case of this survey, pose particular challenges to the researcher. The following guidelines from various academics serve to illustrate the mitigation process, which can be deployed in an instance where research is conducted in areas of a sensitive nature:

A qualitative investigation of a particularly sensitive nature conducted by Oskowitz & Meulenberg-Buskens (1997:83), qualified the importance of handling mission critical issues as identified above when the authors stated: "Thus any type of qualitative investigation could benefit from the researchers being skilled and prepared, and the sensitive nature of an investigation into a stigmatizing condition made the need for such an undertaking even more imperative in the current study".

The sensitivity of certain issues and issues identified as impacting the research negatively in the environments being evaluated, not only demand intimate personal involvement, but also demand the 'personal and practical experience' of the researcher. This view was upheld by Meulenberg-Buskens (1997:83), as being imperative to assure quality in qualitative research being undertaken. Checkland (1989:152), supports this view however extends the concept with the opinion that: "The researcher becomes a participant in the action, and the process of change itself becomes the subject of research".

4.8 SURVEY DESIGN

Collis & Hussey (2003:60-66), articulates the opinion that, research should be well structured to optimally utilise the opportunities and resources available. Furthermore, if it is to provide a logical route to a reliable outcome, it must be conducted in methodical manner using appropriate methods to collect and analyse the data. A survey should be designed in accordance with the following stages:

- > Stage one: Identify the topic and set some objectives.
- > Stage two: Pilot a questionnaire to find out what people know and what they see as the important issues.
- **Stage three:** List the areas of information needed and refine the objectives.
- > Stage four: Review the responses to the pilot.
- > Stage five: Finalise the objectives.
- > Stage six: Write the questionnaire.
- > Stage seven: Re-pilot the questionnaire.
- > Stage eight: Finalise the questionnaire.
- > Stage nine: Code the questionnaire.

The survey design to be used in this instance is that of the descriptive survey as opposed to the analytical survey. The descriptive survey is according to Collis & Hussey (2003:60-66), frequently used in business research in the form of attitude surveys. The descriptive survey as defined by Ghauri, Gronhaug and Kristianslund (1995:60), has furthermore the characteristics to indicate how many members of a particular population have a certain characteristic

The statements within the survey have been designed with the following principles in mind:

- > Avoidance of double-barrelled statements.
- Avoidance of double-negative statements.
- > Avoidance of prestige bias.
- Avoidance of leading statements.
- Avoidance of the assumption of prior knowledge.

Statements were so formulated as to allow the same respondents to respond to each of the two questionnaires, to determine if a paradigm shift occurred after the concept of 'knowledge management' was adopted.

4.9 THE VALIDATION SURVEY QUESTIONS

The researcher acknowledges that results acquired from the research should not be generalized. Babbie (2005:285) is of the opinion that survey research is commonly strong on reliability and weak on validity.

4.9.1 ICT Confidence Questionnaire

Question 1: Computers did not form part of my schooling curriculum. To what extent do you personally agree or disagree with this statement?

Question 2: I do not like working with computers. To what extent do you personally agree or disagree with this statement?

Question 3: I am comfortable to use the computer for lecturing purposes. To what extent do you personally agree or disagree with this statement?

Question 4: I am confident to use the computer for lecturing purposes. To what extent do you personally agree or disagree with this statement?

Question 5: I lack the necessary skills to optimally use the computer. To what extent do you personally agree or disagree with this statement?

Question 17: My daily administration task is simplified through the use of a computer. To what extent do you personally agree or disagree with this statement?

Question 7: To have administrative templates online, would greatly simplify reporting

tasks. To what extent do you personally agree or disagree with this statement?

Question 8: Information Communication Technology does not really help me in my job. To what extent do you personally agree or disagree with this statement?

Question 9: The fact that assessments and reports are electronic, have simplified the

process. To what extent do you personally agree or disagree with this statement?

Question 10: If school policies were placed on a central database and be freely and readily available to anyone, would encourage people to access it and familiarize themselves with the policies as opposed to the current situation. To what extent do you personally agree or disagree with this statement?

Question 11: I do not like to use a computer as a teaching medium as it curtails my teaching ability. To what extent do you personally agree or disagree with this statement?

Question 12: Integrating ICT into the teaching methods is more beneficial to students than using conventional teaching methods. To what extent do you personally agree or disagree with this statement?

Question 13: I often use the Internet and other electronic sources (i.e. Encarta) in the preparation of lectures. To what extent do you personally agree or disagree with this statement?

Question 14: I never find any relevant information on the internet or other electronic sources (i.e. Encarta) to prepare my lectures. To what extent do you personally agree or disagree with this statement?

Question 15: Learners are actively encouraged to use the Internet and other electronic sources (i.e. Encarta) in preparation of projects and class work. To what extent do you personally agree or disagree with this statement?

Question 16: Information Communication Technology is a valuable mechanism for students to acquire new knowledge. To what extent do you personally agree or disagree with this statement?

Question 17: Advances in technology and teaching methods dictates that I would need to develop my skills and knowledge of the computer. To what extent do you personally agree or disagree with this statement?

Question 18: I do not see any benefit for students in using ICT in my approach to teaching. To what extent do you personally agree or disagree with this statement?

4.9.2 The Current Situation and Needs Assessment Focus Group with Educators

Topics for discussion pre-implementation and development will be as follows:

- > Establishing the current situation.
- > To ascertain what the underlying or fundamental problems with the current system/process is.
- To determine what is needed to streamline the ICT integration process to enhance the teaching, learning and administrative experience as a whole.

Topics for discussion post implementation are as follows:

- > To determine whether the implementation has improved the process in place.
- > To determine whether sufficient training has been provided.
- > How has ICT affected teaching and administrative duties.
- Are there any problems or underlying issues that are evident.
- Any other issues that may arise with regards to the ICT model being implemented.

4.9.3 Student Observations

The researcher aims to establish the level of ICT literacy amongst the sample of learners from Grade R to Grade Seven.

4.10 CONCLUSION

In this chapter, the 'ICT confidence' survey design and methodology was Addressed under the following functional headings:

- > Survey environment.
- > Aim of the chapter.
- > Choice of sampling method.
- > Target population.
- > Data collection.
- > Measurement scales.
- Demand for a qualitative research strategy.

- > Survey sensitivity.
- > Survey design.
- > Survey questions.
- Focus Group Topics.
- > Aim of observation.

In Chapter 5, results from the survey will be analysed in detail and conclusions drawn. In addition, recommendations will be made to mitigate the research problem.

CHAPTER 5: DATA ANALYSIS AND INTERPRETATION OF RESULTS

5.1 INTRODUCTION

This chapter discusses the statistical analysis of the information received from the survey at the HCSS which was undertaken to determine the current level of Information Communication Technology (ICT) integration present in the school. The information obtained from the questionnaires posted to the educators of the school, will be presented and analysed in this chapter.

5.2 ANALYSIS METHOD

To serve the purpose of this research, descriptive statistics are used to analyse the data. The descriptive statistics used, are frequency tables as displayed in Paragraph 5.3, showing the distributions of statement responses and means and standard deviations for each statement. The questionnaire is tested for internal reliability and/or consistency.

5.2.1 Validation Survey Results

The survey consisted out of 20 respondents (educators from the HCSS) who responded to 18 statements posed to them. A descriptive analysis to show the distribution of answers on each question is reflected in the first part of the analysis. In order for completeness of reporting the outcome of the survey, the distribution of each variable (answers on each statement) is indicated in table format. Each variable is tested to fall within the boundaries.

5.2.2 Data Format

The data provided in its original questionnaire format was captured in a database in MicroSoft Access, which was developed for the sole purpose of capturing the questionnaire. It was then imported into SAS-format through the SAS ACCESS

module. The statements (variables) in the database are numbered according to their questionnaire number. In case of categorical information the answers are also formatted according to the questionnaire indications. For instance in this case:

- ➤ 1=Strongly agree;
- \geq 2=Agree;
- > 3=Undecided:
- ➤ 4=Disagree;
- > 5=Strongly disagree.

5.2.3 Descriptive Statistics

Descriptive statistics was performed on all variables; displaying means, standard deviations, frequencies, percentages, cumulative frequencies and cumulative percentages. These descriptive statistics are discussed in Paragraphs 5.3.1 (Also see computer printout in Annexure A).

5.2.4 Inferential Statistics

The following inferential statistics are performed on the data:

- Reliability analysis (Cronbach's alpha coefficient to determine consistency).
- > Chi-square for equal proportions to determine whether the educators equally agree or disagree on each statement.

5.2.5 Sample

The target population is educators from the HCSS. A random sample of 20 was drawn out of a possible 30 educators from the school. Note should be taken that any inference that are made can only be made in connection of the HCSS.

5.3 ANALYSIS

In total 20 learners from the HCSS completed the questionnaire. The researchers' main purpose of the study is to determine the level of ICT literacy amongst the

learners to ultimately formulate a conceptual model and as a result this analysis will mainly be descriptive of nature.

All the statements used a 5 point Likert scale as response method, thus an ordinal scale and descriptive and inferential statistics for continuous data can be used.

5.3.1 Descriptive Statistics

In Tables 5.1 and 5.2 the descriptive statistics for all the responses on the statements are presented. It shows the frequencies in each category and the percentage out of total sample. Take note that the descriptive statistics are based on the total sample. In some cases the respondents didn't indicate their response on a statement. These non responses are also included and are indicated as the "unknown" category.

TABLE 5. 1: Descriptive statistics for discrete data

Variables	Categories	Frequency	Percentage
			out of total
Computers did not form part of my schooling curriculum.	Strongly agree	11	55.0%
	Agree	3	15.0%
	Undecided	0	0.0%
	Disagree	5	25.0%
	Strongly disagree	1	5.0%
2. I do not like working with computers.	Strongly agree	: 1	5.0%
	Agree	1	5.0%
	Undecided	1	5.0%
	Disagree	9	45.0%
	Strongly disagree	7	35.0%
	Unknown	1	5.0%
3. I am comfortable to use the computer for lecturing purposes.	Strongly agree	4	20.0%
	Agree	. 4	20.0%
	Undecided	4	20.0%
	Disagree	5	25.0%
	Strongly disagree	2	10.0%
	Unknown	1	5.0%

Variables	Categories	Frequency	Percentage
아니라는 아이들이 아는 것이 되었다. 그 아이들이 아이들이 되었다. 그 그 그 그 그 그 그 그 그 그 그 그 그 그 그 그 그 그 그			out of total
4. I am confident to use the computer for lecturing purposes.	Strongly agree	3	15.0%
	Agree	4	20.0%
	Undecided	2	10.0%
	Disagree	5	25.0%
	Strongly disagree	6	30.0%
5. I lack the necessary skills to optimally use the computer.	Strongly agree	7	35.0%
	Agree	6	30.0%
	Undecided	0	0.0%
	Disagree	6	30.0%
	Strongly disagree	1	5.0%
6. My daily administration task is simplified	Strongly agree	7	35.0%
through the use of a computer.	Agree	7	35.0%
	Undecided	4	20.0%
	Disagree	2	10.0%
7. To have administrative templates online, would greatly simplify reporting tasks.	Strongly agree	6	30.0%
	Agree	11	55.0%
	Undecided	3	15.0%
8. ICT does not really help me in my job.	Strongly agree	. 2	10.0%
	Agree	2	10.0%
	Undecided	: 1	5.0%
	Disagree	10	50.0%
	Strongly disagree	5	25.0%
9. The fact that assessments and reports are	Strongly agree	8	40.0%
electronic, have simplified the process.	Agree	10	50.0%
	Undecided	2	10.0%
10. If school policies were placed on a central	Strongly agree	6	30.0%
database and be freely and readily available to anyone, it would encourage people to access and familiarize themselves with the policies as opposed to the current situation.	Agree	7	35.0%
	Undecided	7	35.0%
11. I do not like to use a computer as a teaching	Agree	4	20.0%
medium as it curtails my teaching ability.	Undecided	3	15.0%
	Disagree	9	45.0%

Vai	riables	Categories	Frequency	Percentage	
				out of total	
		Strongly disagree	4	20.0%	
12.	Integrating ICT into the teaching methods	Strongly agree	2	10.0%	
	is more beneficial to students than using	Agree	7	35.0%	
	conventional teaching methods.	Undecided	6	30.0%	
		Disagree	5	25.0%	
13.	I often use the Internet and other electronic	Strongly agree	3	15.0%	
	sources (i.e. Encarta) in the preparation of	Agree	9	45.0%	
	lectures.	Undecided	0	0.0%	
		Disagree	4	20.0%	
		Strongly disagree	4	20.0%	
14.	I never find any relevant information on the	Undecided	3	15.0%	
	Internet or other electronic sources (i.e.	Disagree	11	55.0%	
	Encarta) to prepare my lectures.	Strongly disagree	6	30.0%	
15.	Learners are actively encouraged to use the	Strongly agree	6	30.0%	
	Internet and other electronic sources (i.e. Encarta) in preparation of projects and class work.	Agree	14	70.0%	
16.	ICT is a valuable mechanism for students	Strongly agree	11	55.0%	
	to acquire new knowledge.	Agree	9	45.0%	
17.	Advances in technology and teaching	Strongly agree	8	40.0%	
	methods dictate that I would need to develop my skills and knowledge of the computer.	Agree	. 12	60.0%	
18.	I do not see any benefit for students in	Strongly agree	1	5.0%	
	using ICT in my approach to teaching.	Undecided	1	5.0%	
		Disagree	12	60.0%	
		Strongly disagree	6	30.0%	

Other descriptive statistics including mean and standard deviation are shown in Table 5.2.

 TABLE 5. 2:
 Descriptive statistics for continious data

Sta	tement	N	Median	Mean	Standard
	Brazilia de elegitation (Cita de la casa de La casa de la casa de Reservo de la casa de Reservo de la casa de la				Deviation
1.	Computers did form part of my schooling curriculum.	20	5.00	3.90	1.4473
2.	I do like working with computers.	19	2.00	1.9474	4.0788
3.	I am comfortable to use the computer for lecturing purposes.	19	3.00	2.84	1.3442
4.	I am confident to use the computer for lecturing purposes	20	4.00	3.35	1.4965
5.	I have the necessary skills to optimally use the computer.	20	4.00	3.60	1.3917
6.	My daily administration task is simplified through the use of a computer.	20	2.00	2.05	0.9987
7.	To have administrative templates online, would greatly simplify reporting tasks.	20	2.00	1.85	0.6708
8.	ICT does really help me in my job.	20	2.00	2.30	1.2607
9.	The fact that assessments and reports are electronic, have simplified the process.	20	2.00	1.70	0.6569
10.	If school policies were placed on a central database and be freely and readily available to anyone, it would encourage people to access and familiarize themselves with the policies as opposed to the current situation.	20	2.00	2.05	0.8256
11.	I do like to use a computer as a teaching medium as it extend my teaching ability.	20	2.00	2.35	1.03999
12.	Integrating ICT into the teaching methods is more beneficial to students than using conventional teaching methods.	20	3.00	2.70	0.9787

1.4609
1
0.6708
0.4702
0.5104
0.5026
0.9119

5.3.2 Uni-variant Graphs

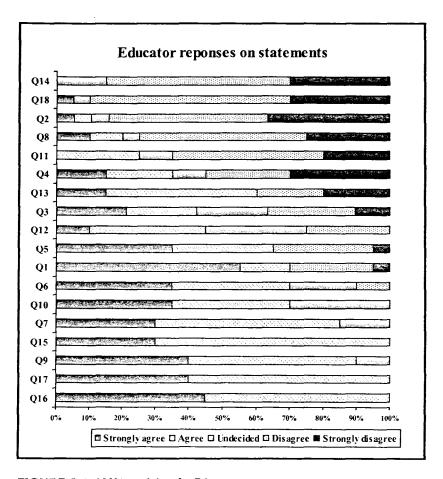


FIGURE 5. 1: 100% stack bar for Educator responses

It can be seen from the descriptive statistics that the educators are positive about the following:

- Information Communication Technology is a valuable mechanism for students to acquire new knowledge.
- Advances in technology and teaching methods dictates for the educator to develop their skills and knowledge of the computer.
- Electronic assessments and reports, simplify the process.
- Learners are actively encouraged to use the Internet and other electronic sources in preparation of projects and class work.
- Administrative templates online will greatly simplify reporting tasks.
- > School policies on a central database which is freely and readily available, will encourage people to access it and familiarize themselves with the policies.
- Daily administrative tasks is simplified through the use of a computer

- Not part of their schooling curriculum.
- Lack the necessary skills to optimally use the computer.

The educators disagreed (negative) on the following statements, but due to the fact that it was negatively stated statements, it can be seen as positive response:

- > ICT does not really help me in my job.
- I do not like working with computers.
- I do not see any benefit for students in using ICT in my approach to teaching.
- > I never find any relevant information on the Internet or other electronic sources to prepare my lectures.
- > I do not like to use a computer as a teaching medium as it curtails my teaching ability.

5.3.3 Inferential Statistics

5.3.3.1 Reliability Testing

Cronbach's Alpha is an index of reliability associated with the variation accounted for by the true score of the "underlying construct". Construct is the hypothetical variables (statements) that are being measured (Cooper & Schindler, 2006:216-217). More specific, Cronbach's alpha measures how well a set of items (or variables) measures a single uni-dimensional latent construct.

The reliability test (Cronbach's Alpha Coefficient) on all the items (statements) which represent the measuring instrument of this survey, with respect to the educators' responses rendered this questionnaire to be reliable and consistent. The results are represented in Table 5.2. Negative phrased questions were reversed scored. These questions are indicated with an "n" on the end. These statements were negatively put, and to adjust for double negative if respondents disagree on an already negative question it gives a positive; it was transformed by subtracting 6 from the value it takes, thus makes the positive perception, negative and the negative perception, positive. These questions can then be changed to positive phrased questions as indicated in the next table.

 TABLE 5. 3:
 Cronbach's Alpha Coefficient for educator questionnaire.

Sta	ements	Variable	Correlation	Cronbach's
		nr.	with total	Alpha
				Coefficient
1.	Computers did form part of my schooling curriculum.	Qln	0.4601	0.9064
2.	I do like working with computers.	Q2n	0.8078	0.8937
3.	I am comfortable to use the computer for lecturing purposes.	Q3	0.7129	0.8964
4.	I am confident to use the computer for lecturing purposes	Q4	0.6346	0.9002
5.	I have the necessary skills to optimally use the computer.	Q5n	0.6632	0.8984
6.	My daily administration task is simplified through the use of a computer.	Q6	0.8138	0.8943
7.	To have administrative templates online, would greatly simplify reporting tasks.	Q7	0.6088	0.9019
8.	ICT does really help me in my job.	Q8n	0.5275	0.9029
9.	The fact that assessments and reports are electronic, have simplified the process.	Q9	0.4389	0.9048
10.	If school policies were placed on a central database and be freely and readily available to anyone, it would encourage people to access and familiarize themselves with the policies as opposed to the current situation.	Q10	0.6229	0.9003
11.	I do like to use a computer as a teaching medium as it extend my teaching ability.	Qlln	0.8048	0.8942
12.	Integrating ICT into the teaching methods is more beneficial to students than using conventional teaching methods.	Q12	0.6302	0.8994
13.	I often use the Internet and other electronic sources (i.e. Encarta) in the preparation of lectures.	Q13	0.7408	0.8955
14.	I always find any relevant information on the Internet or other electronic sources (i.e. Encarta) to prepare my lectures.	Q14n	0.6138	0.9015
15.	Learners are actively encouraged to use the	Q15	0.2204	0.9082

Stat	Internet and other electronic sources (i.e.	Variable nr.	Correlation with total	Cronbach's Alpha Coefficient
And in the control of	Encarta) in preparation of projects and class work.			
16.	ICT is a valuable mechanism for students to acquire new knowledge.	Q16	0.1346	0.9093
17.	Advances in technology and teaching methods dictate that I would need to develop my skills and knowledge of the computer.	Q17	0.4210	0.9056
18.	I do see the benefit for students in using ICT in my approach to teaching.	Q18n	0.3655	0.9064
Cro	nbach's Coefficient Alpha for standardized var	able		0.9101
Cro	nbach's Coefficient Alpha for raw variables			0.9063

5.3.3.2 CHI-SQUARE FOR EQUAL PROPORTIONS.

The chi-square tests for equal proportions were performed on the statements to indicate whether one choice was preferred above another. Table 5.3 shows the statistical results. The Chi-square tests are probably the most widely used nonparametric test of significance that is useful for tests involving nominal data, but it can be used for higher scales as well like cases where persons, events or objects are grouped in two or more nominal categories such as 'yes-no' or cases A, B, C or D. The technique is used to test for significant differences between the observed distribution of data among categories and the expected distribution based on the null hypothesis. It has to be calculated with actual counts rather than percentages (Cooper & Schindler, 2006:499).

Due to the fact that there are only 20 educators in the sample, for most of the statements the cells had an expected frequency of less than 5, in which case the chi-square test may become invalid. To overcome this problem some of the categories which mean approximately the same are aggregated. That is for instance to combine all the agree categories and all the disagree categories, leaving out the degree with which they disagree or agree.

There is evidence that the proportions for some of the statements were not equal. The chi-square test for equal proportions show that the H_0 : $P_1=P_2$ are to be rejected, thus $P_1\neq P_2$. This means that a significant higher / lower proportion of respondents indicated one category rather than one of the other categories. For instance, statistically significant more respondents 'Strongly disagree' and 'Disagree' (90%) than 'Agree' 'and 'Strongly agree' (5%) or 'Undecided' (5.0%) for the statement: "I do not see any benefit for students in using ICT in their approach to teaching".

These significant differences are shown in Table 5.3. All the comparisons are shown in Annexure B.

Even after combining some categories most of expected frequencies were still less than 5. In these cases it must be noted that chi-square my not be valid.

TABLE 5. 4: Chi-Square tests for equal proportions.

Question / Statement		Sample	Chi-Square	DF	P-Value
3.ac		Size			
2.	I do like working with computers.	20	22.2105	2	<0.0001***
4.	I am confident to use the computer for lecturing purposes	20	6.1000	2	0.0474*
6.	My daily administration task is simplified through the use of a computer.	20	12.4000	2	0.0020**
7.	To have administrative templates online, would greatly simplify reporting tasks.	20	9.8000	2	0.0017**
8.	ICT does really help me in my job.	20	16.3000	2	0.0003***
9.	The fact that assessments and reports are electronic, have simplified the process.	20	12.8000	1	0.0003***
11.	I do like to use a computer as a teaching medium as it extend my teaching ability.	20	9.1000	2	0.0106*
14.	I always find any relevant information on the Internet or other electronic sources (i.e. Encarta) to prepare my lectures.	20	9.8000	1	0.0017**
18.	I do see the benefit for students in using ICT in my approach to teaching.	20	28.9000	2	<0.0001***

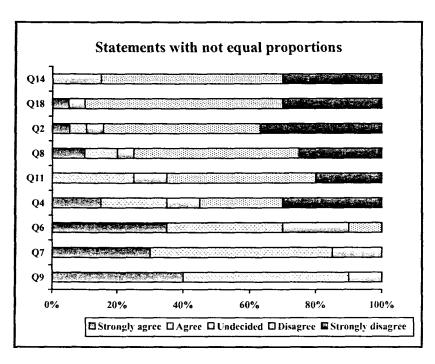


FIGURE 5. 2: 100% stack bar for statements with not equal proportions for responses

5.4 FOCUS GROUP ANALYSIS (PRE-IMPLEMENTATION)

A general consensus was reached that although the necessary ICT infrastructure is in place at the HCSS, the skill set that required is not evident. Educators agreed that attempts have been made to put processes and procedures in place to optimally utilize ICT in of the school but has proven to be an exercise in futility. Factors contributing to this include a lack of staff buy-in, management neglected to formulate a clear vision or a strategic plan and a lack of training.

With regards to administrative duties, educators emphasized that duplication of tasks are prevalent and unnecessary. Administrative duties are still being completed manually when it has the potential to be computerized. Staff indicated the schools policies, procedures, communiqués and reporting documents are not easily accessible.

No formal ICT training has been provided by the school, and according to staff members, this is a major contributing factor as to why ICT is not being used to optimize daily tasks. In order to streamline ICT integration, sufficient and relevant training for staff members should be provided together with an annual refresher course. Staff members concluded that this would be a key enabler for the success of ICT integration. Administrative templates should be developed in order to retain reporting and communication standards throughout the school.

5.5 FOCUS GROUP ANALYSIS (POST-IMPLEMENTATION)

The readers' attention is drawn to the fact that the conceptual model described in Chapter 6, Paragraph 6.7 are implemented in phases and the focus group analysis (post-implementation) refers to group observations pertaining to the elements of the conceptual model implemented thus far.

Educators indicated that the level of training provided by the school has been focused on ICT literacy amongst staff members and integrating ICT into traditional teaching methods.

ICT integration has dramatically enhanced teaching and learning. Learners appear to be more captivated. Educators have a greater source of information available to them in the form of the Internet and Encarta when preparing lessons.

According to staff members, administrative tasks have been significantly simplified by converting these tasks to electronic form. Duplication appears to have been eradicated.

5.6 PARTICIPANT OBSERVATION ANALYSIS

In summary, there appears to be a general lack of basic computer skills. There is evidence that there is an apparent lack of technical knowledge with regards to computer hardware components. Learners are not particularly encouraged to use ICT as a research medium or a formatting medium.

5.7 DISCUSSION AND CONCLUSION

All the educators in the sample agree to some degree (agree or strongly agree) with the following statements:

- Learners are actively encouraged to use the Internet and other electronic sources in preparation of project and class work.
- > ICT is a valuable mechanism for students to acquire new knowledge.
- Advances in technology and teaching methods dictates that I would need to develop my skills and knowledge of the computer.

The following analogies can be drawn from the analysis of the data:

- Educators are not comfortable to use the computer for lecturing purposes,
- > The educators are not apposed to using computers in their work,
- > The educators daily administration task is simplified through the use of a computer,
- > ICT help the educators in their job,
- The computer as a teaching medium, do not curtails educators teaching ability,
- > Relevant information on the Internet and other electronic sources can be found to prepare for educator's lectures,
- They see a benefit for students in using ICT in their approach to teaching.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 BACKGROUND

In the research thus far, the extent of the research was provided in Chapter 1: Scope of the Research. In Chapter 2, a holistic perception on the research environment and the utilisation of technology at the HCSS was provided. In Chapter 3, a literature review was conducted on the issue of ICTechnology and its role in the schooling system with specific focus levelled at the following:

- > The concept of ICT.
- > ICT Defined.
- > The importance of ICT.
- > The impact of ICT.
- > ICT implementation.
- > The application of ICT in Schools.
- > Computer literacy versus conventional teaching methods.
- > Integrating computers into the curriculum.
- > Establishing ICT confidence in staff members.
- > ICT training.
- > Administration ICT.

In Chapter 4, the research design and methodology was elaborated upon to culminate in the data analysis and interpretation of results. In this final Chapter 6, the research will be concluded and final analogies will be drawn.

6.2 THE RESEARCH PROBLEM RE-VISITED

The research problem that was formulated and researched within the ambit of this dissertation reads as follows:

'The poor deployment of ICT within HCSS resulting in inefficient processes adversely impacting on the quality of education provided and efficiency of internal processes.'

The research problem will be mitigated should the recommendations contained in this chapter be implemented.

6.3 RESEARCH QUESTION RE-VISITED

The research question which formed the core of this dissertation reads as follows: 'What mechanistic approach can be deployed at the HCSS to integrate ICT within the organisation to improve the quality of education and improve on the efficiency of internal processes?'

Briscoe and Lee (2005: **O**nline), believes that school leaders need to have a clear perspective of the ICT provision throughout their school. They should be able to identify and understand good ICT prerequisites and where they are in relation to it. Once this self review period has concluded, it is crucial to the strategic development of ICT to establish a vision of where they wish to go. A strategic plan that clearly emphasises the vision and mission of automation areas is critical to ICT integration (Sevilla and Shabaya 2007:10). The appropriate skills combined with the appropriate infrastructure and ICT plan should prove to be remarkable during the implementation and application of ICT in education (Kennewell *et al.*, 2008:**O**nline).

6.4 INVESTIGATIVE QUESTIONS RE-VISITED

The investigative questions researched in support of the research question reads as follows:

- ➤ How can learner computer literacy be improved at the HCSS?
- > Can ICT serve as a successful teaching mechanism?
- How can the implementation of an electronic documentation system improve efficiency?
- What approach can be adopted to technologically empower educators and administrative staff?

Eisenberg and Johnson (2002:Online), are of the opinion that there is an increasing consensus that computer literacy means being able to use technology

for communication, organization, research and problem solving. A briefing paper prepared by PJB Associates (2008:Online), concludes the following:

- Dynamic learning environments can be stimulated by innovative use of ICT in teaching/learning.
- > The effectiveness of ICT based innovations, scientific knowledge and/or new educational/pedagogic models rely on their successful integration into existing educational activities.
- ➤ A working definition of ICT-related teaching/learning should focus on the activities of innovators who are integrating into existing activities or new activities, resulting in profound changes, reforms or improvements in teaching learning processes and outcomes.

"In the education sector, curriculum review efforts are geared towards modernisation, including the incorporation of important ICT components. However, even the reviewed curricula tend to treat ICT as a subject rather than as an application tool that can be used in all other subjects, in teaching and learning. Very recent discourse indicates that future curriculum reviews may consider a fully fledged ICT mainstreaming process" (Janssens-Bevernage *et al.*, 2008:**O**nline).

A case study conducted at Hjortespring Skole reached a consensus that ICT is an important area of skill which learners have to be taught (Carlson, Broe, Drewsen, Spenceley 2000:Online). Soule (2003:Online), reviewed the processes of where, why and how computers could be used to enhance teaching and learning experiences, and found that nurturing an intellectually curious learner should be the aim of technologies used at schools. Loveless (2008:Online), stated that ICT can be used to demonstrate and develop cognitive skills and mental structures of a child.

Kader (2008:Online), is of the opinion that any ICT in education professional development programme should have three aspects that should be considered. Firstly educators need to gain the knowledge and judgement to select and evaluate ICT resources that are suitable for teaching and learning in their own subjects. Secondly, teachers need to be able to properly assess when and how to integrate

ICT into their lessons. Kader stated that many aspects of education could be enhanced with the prudent use of technology. A teacher should be able to distinguish between these, and finer, distinctions. Thirdly, teachers should be able to evaluate the effects of ICT on their teaching and on their students' learning. Should the curriculum be defined in terms of learning outcomes, and standards for ICT-enriched teaching and learning are clearly defined in measurable terms, it would enable the educator to apply the outcome measures, both to their own teaching and to students' results.

Gronn (2007:Online), explored the possibility of teachers aspiring to be more confident and skilful with ICT in their classrooms by relying on the knowledge and skills of children to mentor them in their learning of ICT. Gronn concluded that this study has allowed teachers and learners to let go of the false assumption that educators are the holders of all knowledge. This has in turn enabled them to work together to develop the teachers ICT confidence, skills and knowledge so therefore to improve the uses of ICT in their classrooms.

Teachers should start using technology when they feel comfortable to. As soon as they master one particular task they should look at how they can add value in the classroom. This pertains to integrating IT in the classroom and in an administrative manner. According to O' Grady (2007:19), teachers from Ireland who participated in this study displayed a lack of practical experience with regard to using ICT in the classroom. It was suggested that a more positive environment be established to promote ICT use. Furthermore, student teachers should be placed with ICT-literate teachers for the duration of their practice teaching. It was also determined that by gaining confidence and experience in using technology proved to be valuable in gaining employment.

"The application of ICT can only be successful if the relevant role players are provided with a working level of training so as to optimally use the ICT capabilities" (Zammit 2008:Online). Having the necessary infrastructure in place is pointless if the key role players (educators) do not realise its true potential and embrace technology. Providing relevant educator training is the key to the success of this innovation (Zammit 2008:Online).

Sevilla and Shabaya (2007:1) citing Wanyembi (2002), confirmed that academic institutions have started automating core functions. These functions include student admission process, estate management, fees payment, examination records management and library services among other functions. Anderson's Creek Primary School, Australia has successfully integrated their administrative tasks with technology by means of an intranet. Here they have all processes and procedures as well as documentation staff may need, readily available. (Reagan *et al.*, 2003:Online). O'Grady (2007:16) found that Irish teachers expressed concern not only about the amount of paperwork involved in their daily administrative routine but the accountability thereof. HM Inspectors of Education (2005:Online), in their research found that the most evident administrative development was the increasing development in the secondary sector of information management systems to track and record pupil progress.

6.5 KEY RESEARCH OBJECTIVE RE-VISITED

The aim of this study was to formulate a conceptual model that facilitates improved computer literacy among educators and learners. The model should provide for computer training, curriculum development for the integration of technology in the classroom, and an effective documentation and administrative system. The model should furthermore have the potential to, from a practical perspective, culminate in a viable mechanism to optimise the use if ICT within the HCSS. This key research objective would be attained with the implementation of the conceptual model depicted in Figure 6.1.

6.6 RECOMMENDATIONS

Mapping the research design and methodology as described in Chapter 1, Paragraph 1.5, where 'Action Research' (Collis and Hussey, 2003:65, Coghlan and Brannick, 2002:6-7) served as the ruling research method, the conceptual model as described in Paragraph 6.7 was partially implemented (Refer Chapter 5, Paragraph 5.5). It is furthermore recommended, to totally mitigate the research problem as defined and to provide an answer to the research question to fully implement the conceptual model. The readers' attention is drawn to the fact that

the total implementation of the conceptual model is planned to take place during 2009/2010 as progress is impacted upon by shortage of skills and available funds.

6.7 CONCEPTUAL MODEL

The conceptual model depicted in Figure 6.1 served as basis for the mitigation of the research problem with the HCSS.

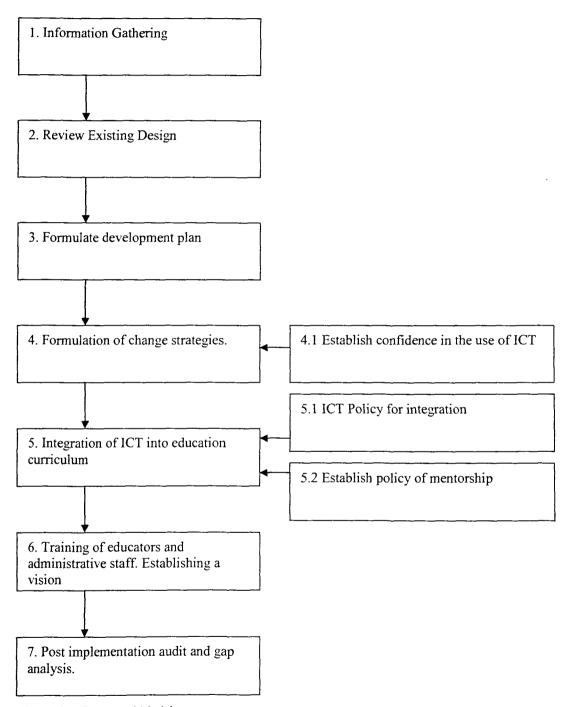


Figure 6.1: Conceptual Model

Each of the reference keys reflected in Figure 6.1 are elaborated upon below, for ease of reference.

- 1. **Information gathering:** Encompasses a needs assessment, and cost benefit analysis (Sevilla & Shabaya, 2007:10).
- 2. **Review existing design:** According to Becta (2006:**O**nline) the following need to be addressed:
 - Assess the quality of facilities and services required by the ICT development plan.
 - ➤ Audit existing ICT equipment age and costs.
 - Identify the impact of existing ICT and practices on staff (and possibly learner) satisfaction, confidence and competence.
 - > Review staff training needs.
 - Compare current costs against relevant benchmarks.
 - Review purchasing practice and value-for money processes.
 - Compare actual ICT support needs against the quality and value of current technical support and compliance with FITS.
 - Reassess the quality of facilities and services needed to support the ICT development plan in the light of these reviews (points 2–7).
 - Plan and introduce a rolling three-year whole school budget, allocating a realistic proportion to ICT.
- 3. Formulate development plan: According to Daly (2001:Online) citing Byron (1998), the need for a detailed plan for professional development has to be identified as one of the prime necessities for success in educational technology projects. Ntetha (2005:Online), identify three elements in successfully implementing a technology plan for a school, namely:
 - > Appropriate hardware and software,
 - > Computer literate staff, and a
 - > Technology curriculum.
- 4. **Formulation of change strategies:** A formal change management strategy should be implemented when ICT is implemented in a school environment (Ping,2008:Online; Yuen *et al.* citing Fullen,1992; Thorburn, 2008:Online and Sevilla and Shabaya, 2007:10).

- 4.1 Establish confidence in the use of ICT: Kader (2008:Online), is of the opinion that any ICT in education professional development programme, there are three aspects that should be considered. Firstly educators need to gain the knowledge and judgment to select and evaluate ICT resources that are suitable for teaching and learning in their own subjects. Secondly, teachers need to be able to properly assess when and how to integrate ICT into their lessons. Kader (2008:Online) is further of the opinion that many aspects of education can be enhanced with the prudent use of technology. A teacher needs to be able to distinguish between these and finer distinctions. Thirdly, teachers need to able to evaluate the effects of ICT on their teaching and on their student learning. If the curriculum is defined in terms of learning outcomes, and standards for ICT-enriched teaching and learning are clearly defined in measurable terms, then the teacher would be able to apply the outcome measures, both to their own teaching and to student results.
- 5. Integration of ICT into education curriculum: Future curriculum review may consider a fully fledged ICT mainstreaming process (Janssens-Bevernage et al., 2008:Online), reflecting the higher order skills of planning to use ICT, making decisions concerning appropriate resources and techniques, monitoring progressing and evaluating outcomes (Kennewell et al.,2000:Online). According to Eisenburg and Johnsons (2002:Online), it is imperative that ICT is integrated into the curriculum, so that learners are bought how to use technology to their benefit.
- 5.1 ICT Policy for integration: O' Grady (2007:12-13), suggest that the following policy principals form the basis of ICT integration:
 - ICT should be used actively by learners from junior infants onwards;
 - all learners should use ICT in relevant curriculum contexts;
 - by the end of compulsory education all students should have achieved a defined level of ICT competence.
- 5.2 **Establish policy for mentorship:** Teams, with one ICT skilled person are established on the talents and strength of each staff member. Follow a team program using the ICT skilled person as a mentor (Reagan *et al.*, 2003:**O**nline).

- 6. Training of educators and administrative staff. Establishing a vision:

 According to Zammit (2008:Online), the application of ICT can only be successful if the relevant role players are provided with a working level of training so as to optimally use ICT capabilities. Jung (2005:Online), in turn is of the opinion that ICT may provide more flexible and effective ways for life long professional development for educators. All documentation (currently paper based and manual) to be automated. Develop generic templates to facilitate workflow. Establishment of an Intranet (Sevilla and Shabaya (2007:1) citing Wayembi, 2002; Reagan et al., 2003:Online; HM Inspectors of Education, 2005:Online). According to Schreurs (2007:Online), the ability to improve teaching, learning and achievement should be the driving factors behind the ICT vision.
- 7. **Post implementation audit and gap analysis:** Conduct a post implementation audit to identify gaps in the conceptual model and restructure the model to close the gaps.

6.8 CONCLUSION

In a developing country like South Africa, it is an absolute requirement for the future of the country to develop a sound education infrastructure to the benefit of not only the youth, but also the country. Using ICT can exponentially facilitate this objective, however requires a structured approach there to optimally benefit from its potential.

BIBLIOGRAPHY

ANONYMOUS 1. 2008. Vision on ICT & Education. Available from: http://www.tilburguniversity.nl/faculties/feb/organisation/fo/ictunit/zz/visiononict education.pdf. Accessed May 2008

ANONYMOUS 2. 2008. Organisational factors in ICT design and implementation Available from: http://www.ukwon.net/files/Theme36.pdf. Accessed June 2008

ANONYMOUS 3. 2004 . Partnership for 21st Century Skills Highlights Importance of ICT Literacy at U.S. Department of Education Leadership Summit. Available from: http://www.itstrategies.com/pressarchive/03102004_p21.pdf. Accessed May 2008.

ANONYMOUS 4. 2008. ICT in Education. Available from: http://www.mydigitallife.info/2008/03/04/ict-in-education/. Accessed May 2008.

BABBIE, E. 2005. The basics of Social Research. Blemont: Thomson.

BALANSKAT, A. BLAMIRE, R. & KEFALA, S. 2006. The ICT Impact Report - A review of studies of ICT impact on schools in Europe. Available from: http://ec.europa.eu/education/doc/reports/doc/ictimpact.pdf. Accessed July 2008.

BECTA. 2006. Managing ICT costs in Schools Available from http://www.industry.becta.org.uk/download.cfm?resID=25943. Accessed June 2008.

BEKKERS, A.M. 2006. Interview with Researcher. Cape Town. Interview (Interview notes in possession of the author).

BENTING, L. 2006. Interview. Cape Town. Interview notes in possession of the author.

BRISCOE, M. & LEE, P. 2005. Support for Strategic Leadership of ICT – an English Model, Available from:

http://insight.eun.org/ww/en/pub/insight/thematic_dossiers/articles/leadership/bect a_leadership.htm. Accessed May 2008.

CARLSEN, A. BROE, L. DREWSEN, U.M. & SPENCELEY, L. 2000. A Case Study of ICT and Organisational Change at Hjortespring Skole – Denmark Available from: http://www.oecd.org/dataoecd/25/58/2736856.pdf. Accessed July 2008.

CHECKLAND, P. 1989. Systems Thinking, Systems Practice. John Wiley & Sons. Chichester. New York. Brisbane. Toronto.

CHUNG, T.K. 2005. Successful ICT implementation in school - Two Prerequisites. Available from: www.thecorner.org/ict/ict_leadership.htm. Accessed April 2007.

CUBAN, L. 2001. Oversold and Underused: Computers in the Classroom. Cambridge, MA: Harvard University Press.

COGHLAN, D. & BRANNICK, T. 2002. Doing Action Research in your own Organization. London: Sage.

COHEN, A. TZATZASHVILI, M. YARON, Y. OSHRI, T. & GERTMAN, T. 2001. A Case Study of ICT-Enriched School Environment at Cramim School, Rishon Le-Zion, Israel, Available from: http://intradev.oecd.org/els/ict/il/il02.html. Accessed April 2007.

COLLIS, J. & HUSSEY, R. 1997. Business Research: A practical guide for undergraduate and post graduate students. Macmillan Press: Houndmills.

COOPER, P.S. & SCHINDLER, D.R. 2006. *Business Research Methods*. Seventh/Eight Edition. New York, NY. McGraw-Hill.

COOK, D. 2008. ICT and curriculum provision in early years. Available from: http://books.google.co.za/books?id=aTHN_UCm-

j4C&pg=PA101&lpg=PA101&dq=The+idea+that+%E2%80%98new+forms+of+learning%E2%80%99+associated+with+ICT+might+conflict+with+older+forms+is+particularly+pertinent+to+early+childhood+education+where+debate+surrounding+the+nature+of+the+curriculum+has+been+particularly+intense&source=web&ots=nVUJg1BbTM&sig=uRbMJcPezrFYLiSCmckXJEPJ02c&hl=en&sa=X&oi=book_result&resnum=1&ct=result_Accessed_June_2008.

DALY, T. 2001. Finding a Fit for ICT: Issues from the DATE SOLAS Process. Available from: http://www.enabletech.ie/finding-fit.htm. Accessed May 2008.

DEPARTMENT FOR EDUCATION AND SKILLS UK. 2004. ICT across the Curriculum ICT in .history. Available from:

http://www.standards.dfes.gov.uk/secondary/keystage3/downloads/ictac_hi01920 4.pdf. Accessed February 2007.

ELSTON, C. 2007. Using ICT in the Primary School. Available from: <a href="http://books.google.co.za/books?id=pJtex8MaWZ4C&pg=PA5&lpg=PA5&dq=Elston++the+technology+used+to+manage+information+and+aid+communication-asource=web&ots=VQY4tlHrkJ&sig=5VRF5gNZSxzNgnFKfHeb5NNLPhA&hl=en&sa=X&oi=book_result&resnum=1&ct=result. Accessed February 2008.

EMORY, C.W. & COOPER, D.R. 1995. Business Research Methods. Fifth Edition. Irwin: Homewood.

EISENBERG, M.B. & JOHNSON, D. 2002. Learning and Teaching Information Technology Computer Skills in Context. [Online] Available from: September 2006 from http://www.big6.com/showarticle.php?id=82

FORSTER, P.A. DAWSON, V.M. & REID, D. 2005. Measuring preparedness to teach with ICT. Available from:

http://www.ascilite.org.au/ajet/ajet21/forster.html. Accessed May 2008.

GAY, L.R. AND DIEBL, P.L. 1992. Research methods for business and management. MacMillan Publishing Company. New York.

GHAURI, P. GRONHAUG, K. & KRISTIANSLUND, I. 1995. Research methods in business studies. Prentice Hall: New York.

GRONN, D. 2007. Changing teacher-student relationships through ICT: Student mentors in Australia, Available from:

www.iste.org/Content/NavigationMenu/Research/NECC_Research_Paper_Archives/NECC_2007/Gronn_Donn_N07.pdf. Accessed June 3.

GUMMESSON, E. 2000. Qualitative Methods in Managing Research. Thousand Oakes:Sage.

HEROD, L. 2002. Adult Learning. Available from:

http://www.nald.ca/adultlearningcourse/glossary.htm. Accessed June 2008.

HIGGINS, S. 2008 Does ICT improve learning and teaching in schools? Available from: https://www.bera.ac.uk/publications/pdfs/ICT%20PUR%20MB%20r-fp%201Aug03.pdf. Accessed April 2007.

HM INSPECTORS OF EDUCATION. 2005. The Integration of Information and Communications Technology in Scottish Schools Available from: http://www.hmie.gov.uk/documents/publication/EvICT%20Final%2018%20Oct.h tml. Accessed June 2008.

JAGER, A.K. & LOKMAN, A.H. 1999. Impacts of ICT in education. The role of the teacher and teacher training. Available from: www.leeds.ac.uk/educol/documents/00001201.htm Accessed July 2008.

JANSSENS-BEVERNAGE, A. CORNILLE, B. MWANIKI, N. 2008. Integrating ICT in Teacher Training: Reflections on Practice and Policy Implications - A Case Study of the Learning Resource Centre at the Kenya Technical Teachers

College Available from: http://www.idrc.ca/en/ev-93060-201-1-
DO TOPIC.html. Accessed June 2008.

JOHN, P.D. 2008. Teaching and Learning with ICT New Technology, New Pedagogy? Available from: http://www.interactiveeducation.ac.uk/out_joh.pdf. Accessed May 2008.

JUNG, I. 2005. ICT-Pedagogy Integration in Teacher Trainng: Application Cases Worldwide [Online] Available from: http://www.ifets.info/journals/8_2/8.pdf. Accessed July 2008.

KADER, B.K.B.A. 2008. Malaysia's Experience in Training Teachers to Use ICT. Available from: http://unesdoc.unesco.org/images/0015/001567/156757e.pdf. Accessed June 2008.

KANDIRI, J.M. 2008. ICT Policy in Kenya and ways of improving the Existing ICT Policy. Available from: www.strathmore.edu/research/ict-policy-in-kenya.pdf. Accessed April 2008.

KERLINGER, F.N. 1986. Foundations of behavioural research. CBS College Publishing. New York.

KENNEWELL, S. PARKINSON, J. & TANNER, H. 2000. Developing the ICT Capable School Available from:

http://books.google.co.za/books?hl=en&id=qoV2xKAznv8C&dq=Developing+thep+ICT+Capable+School+By+Steve+Kennewell.+John&printsec=frontcover&source=web&ots=Kdd828lmbs&sig=szgLV1cQoyqnHHWKG3q33My-sv4&sa=X&oi=book_result&resnum=2&ct=result_Accessed March 2008.

KENT COUNTY COUNCIL. 2004. What is ICT? Available from: http://www.kented.org.uk/ngfl/ict/definition.htm.

KORTE, W.B. AND HÜSING, T. 2007. Benchmarking Access and Use of ICT in European Schools 2006: Results from Head Teacher and a Classroom

Teacher Surveys in 27 European Countries. eLearning Papers, vol. 2 no. 1. ISSN 1887-1542.

KOZMA, R.B. 2008. Monitoring and Evaluation of ICT for Education Impact: A Review Available from: www.infodev.org/en/Document.284.aspx. Accessed March 2008.

LOVELESS, A. 2008. Role of ICT. Available from:

http://books.google.co.za/books?hl=en&id=OAOCUm3ZKB4C&dq=Role+of+IC
T+-+Avril+Loveless&printsec=frontcover&source=web&ots=uRa_JMlQp&sig=zrJ5j4B9K5oE769tIUJSRWIldsU&sa=X&oi=book_result&resnum=4&c
t=result_Accessed November 2007.

MEULENBERG-BUSKENS, I. 1997. Turtles all the way down? – On a quest for quality in qualitative research. South African Journal of Psychology. Vol. 27, No. 2, June.

MINISTRY OF WORKS, HOUSING AND COMMUNICATIONS – UGANDA. 2002, National Information and Communication Technology Policy. Available from: http://www.ilo.org/public/english/employment/skills/hrdr/init/uga_1.htm. Accessed May 2007.

MIODUSER, D. NACHMIAS, R. FORKOSH, A. TUBIN, D. COHEN, A. GERTMAN, T. TZATZASHVILI, M. YARON, Y. & OSHRI, T. 2001. A Case Study of ICT and School Improvement at Ohel Shem High School, Ramat Gan, Israel Websites-Construction Project Web Sites Story... [Online] Available from: July 2008 from http://www.oecd.gov.il/files2/7-May-2001.pdf

MONTEITH, M. 2007. ICT for Curriculum Enhancement. Available from: http://books.google.co.za/books?id=aTHN_UCm-j4C&printsec=frontcover&dq=Moira+Monteith&sig=ACfU3U0qOR4VtX-sIBuwfdac0R5fFbWHyg. Accessed November 2007.

NACHMIAS, R. MIODUSER, D. COHEN, A. TUBIN, D. & FORSKOSH-BARUCH, A. 2004. Factors Involved in the Implementation of Pedagogical Innovations Using Technology. Available from:

http://muse.tau.ac.il/publications/86.pdf

NTETHA, M. 2005. The Management of Computer Literacy in Esikhawini Township Secondary Schools. Available from:

http://www.liasa.org.za/conferences/conference2005/retig-sig_pre-conference/Literacy_townships_Ntetha_2005.pdf. Accessed October 2006.

O'GRADY, D. 2007. Information Communication Technology and Newly Qualified Primary Teachers Ireland: School and classroom experience. S.1.: s.n.

OMACHUNU, V.K. & ROSS, J.E. 2004. Principals of Total Quality. Boca Raton:CRC Press.

OSKOWITZ, B. & MEULENBERG-BUSKENS, I. 1997. Preparing researchers for qualitative investigation of a particularly sensitive nature: Reflections from the field. South African Journal of Psychology. Vol. 27, No. 2, June.

PAUL, J.R.M. 1999. Empowering teachers to use computers effectively across the curriculum. Available from:

http://archive.wcape.school.za/mm99/cd/conf99/proceedings/31/CTPAPE~1.rtf. Accessed October 2006.

PARASURAMAN, A. 1991. Market Research. 2nd Edition, Eddision-Wesley.

PJB ASSOCIATES. 2008. Synergy between Practitioners' needs and opportunities, research orientations and decision making on the usage of ICT in primary and secondary education. Available from: www.pjb.co.uk/npl/bp36.htm. Accessed May 2008.

PING, L.C. 2008 ICT Integration into Education: A Case Study of Singapore. Available from:

http://www2.unescobkk.org/education/ict/resources/JFIT/schoolnet/case_studies/S ingapore_ICT.doc. Accessed June 2008.

REGAN, L. ROBERTSON, E. & MCKENZIE, D. 2003. Integration of ICT into the Curriculum at. Anderson's Creek Primary School. Available from: http://crpit.com/confpapers/CRPITV23Regan.pdf. Accessed September 2006.

REMENYI, D. MONEY, A. & TWITE, A. 1995. Effective Measurement & Management of IT Costs & Benefits. Butterworth-Heinemann Ltd. Linacre House, Jordan Hill, Oxford. OX2 8DP.

REMENYI, D. WILLIAMS, B. MONEY, A. & SWARTZ, E. 2002. Doing research in business and management. Sage: London.

SCHREURS, J. 2007. ICT use in School: Vision and Performance measures. Available from:

https://doclib.uhasselt.be/dspace/bitstream/1942/8080/1/ICL07.pdf.Accessed May 2008.

SEVILLA, J. & SHABAYA, P. 2007. Implementing an Academic Management System AMS: The Case of Strathmore University, Strathmore University.

SONG, J. LEE, J.Y. JANG, S.J. & AHN, M.I. 2001. Case Study of ICT and School Reform at Banghwa Elementary School, Seoul, Korea. Available from: http://www.oecd.org/dataoecd/43/49/2741216.pdf. Accessed May 2008.

SOULE, H. 2003. What do you mean by ICT integration? Journal for Educational Reform in Namibia. Available from:

http://www.schoolnetafrica.net/fileadmin/resources/What_do_you_mean_by_ICT integration.pdf. Accessed October 2006.

SWANEPOEL, M. 2007. Informal discussion with the researcher on issues pertaining to the utilisation of ICT at the Holy Cross Sisters' School. (Informal Discussion notes in possession of the author).

THORBURN, D. 2004. Technology Integration and Educational Change: Is it Possible? Available from:

http://www.usask.ca/education/coursework/802papers/thorburn/index.htm. May 2008.

TRINIDAD, S. NEWHOUSE, P. & CLARKSON, B. 2008 A Framework for Leading School Change in using ICT: Measuring Change Available from: www.aare.edu.au/05pap/tri05123.pdf. Accessed June 2008.

TURBAN, E. MCLEAN, E. AND WETHERBY, J. 2002. Information Technology for Management. New York: Wiley.

VOGT, W. P. 1993 Dictionary of statistics and methodology. Newbury Park: Sage

WATKINS, J.A. 2008. Thesis Dissertations Research Reports. Cape Town:Content Solutions.

YUEN, H.K.A. 2008. ICT Implementation at the School Level Introduction, Available from: http://sites.cite.hku.hk/06Pa 03aE.PDF. Accessed May 2008.

YUEN, H.K.A, LAW, N AND WONG, K.C. 2003. ICT implementation and school Leadership. Available from

http://www.emeraldinsight.com/Insight/ViewContentServlet/Filename=/published/emeraldfulltextarticle/pdf/0740410204.pdf. Accessed May 2008.

YIN, R.K. 2003 Case Study Research: Design and Methods. 3rd ed. Sage: Thousand

ZAMMIT, L. 2008. ICT Literacy & Education in Malta. Available from: http://schoolnet.gov.mt/dtie/ICT%20Literacy.doc Accessed May 2008.

ANNEXURE A:

Descriptive statistics for each variable

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Cumulative
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         Ol Frequency Percent Frequency Percent Strongly agree 1 15.00 14 70.00 Disagree 5 25.00 19 95.00 Strongly disagree 1 5.00 20 100.00
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> Chisq 0.0107
Sample Size = 20
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       | O2 | Frequency | Percent | Percent
         Agree
Undecided
Disagree
Strongly disagree
                                                                                                                65.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               Cumulative
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       Cumulative
  cnt-square 3.4000

DF

Pr > Chisq 0.6386

table cells have expected counts less

n 5. Chi-Square may not be a valid test.

Sample size = 20
                                                                                                                  WARNING. The
    Cumulative
| Q5 | Frequency | Percent | Perce
                                                                                                                                                                                                                                                                            DF
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                                                                                                                                                                                                                                                                                                                                                                                                                                           0.2214
= 20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               Cumulative
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  | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cumulative | Cum
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= 20
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  | Cumulative | Cumulative | Q7 | Frequency | Percent | Frequency | Frequ
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Chi-Square 4.9000
DF 2
Pr > ChiSq 0.0863
Sample Size = 20
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      | Q8 | Frequency | Percent | Percent
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               Cumulative
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   Cumulative
                                                                                                                                                       Chi-Square 13.5000
OF
4
Pr > ChiSq 0.0091
WARNING: The table cells have expected counts less
than 5. Chi-Square may not be a valid test.
Sample Size = 20
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   Cumulative
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Cumulative
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          | Old | Frequency | Percent 
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DF 1

Pr > ChiSq 0.0736

Sample Size = 20
| Cumulative | Cumulative | Percent | Frequency | Percent | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       Cumulative
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  Cumulative
          | Q7 | Frequency | Percent | Percent
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 OF 1
Pr > ChiSq 0.0017
Sample Size = 20
Q8 Frequency Percent Frequency Percent Frequency Percent Frequency Percent Frequency Percent Frequency Percent Percen
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 Cumulative
          Q9 Frequency Percent Frequency
```

```
10.00
Chi-Square Yest
for Equal Proportions
ffffffffffffffff
Chi-Square 12.8000
DF 1
Pr > Chisq 0.0003
Sample Size = 20
          undecided
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            100.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             Cumulative
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           Cumulative
       Q10 Frequency Percent Frequency Percent Frequency Percent Frequency Percent Frequency Percent Frequency Percent State Frequency Percent Fr
                                                                                                                                                                                                                                                                                                                                                                          Cni-Square 1.8000

DF 1

Pr > ChiSq 0.1797

Sample Size = 20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              Cumulative
       Oll Frequency Percent Percent Frequency Percent 
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             Cumulative Cumulative
   | Old | Frequency | Percent | Frequency | Percent | Frequency | Percent | Frequency | Percent | 
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             Cumulative Cumulative
   | Cumulative | Cumulative | Cumulative | Odditive | Odd
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       Cumulative
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 Cumulative
       Old Frequency Percent For Equal Percent For Equal Proportions For Equal Proportions Frequency Frequency Percent For Equal Proportions Frequency Frequency Proportions Frequency Frequ
   Q15 Frequency Percent Frequency Percent 100.00 20 100.00 100.00 20 100.00 Chi-Square Test for Equal Proportions fiffiffiffiffiffiffiffiffiffiffichi-Square 0.0000 DF 0 Pr > Chi-Square 20.0000 DF 0 Pr > Chi-Square 20.0000 DF 0 Sample Size = 20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         Cumulative Cumulative
   Pr > ChiSq
Sample Size = 20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      Cumulative Cumulative
| Old | Frequency | Percent | 
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    Cumulative
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    Cumulative
```

The CORR Procedure

			Simple Sta	tistics			
variable	N	Mean	Std Dev	Sum	Minimum	Maximum	Label
q1n	18	3.94444	1.43372	71.00000	1.00000	5.00000	
q2n	18	1.94444	1.10997	35,00000	1.00000	5.00000	
Q3	18	2.88889	1.36722	52,00000	1.00000	5.00000	Q3
Q4	18	3.38889	1.53925	61.00000	1,00000	5.00000	04
q5n	18	3.66667	1.41421	66.00000	1.00000	5.00000	-
Q6	18	2.05556	0.99836	37.00000	1.00000	4.00000	q6
Q7	18	1.94444	0.63914	35.00000	1.00000	3.00000	07
q8n	18	2.38889	1.28973	43.00000	1.00000	5.00000	•
Q9	18	1.77778	0.64676	32.00000	1.00000	3.00000	Q9
Q10	18	2.11111	0.83235	38,00000	1.00000	3.00000	Q10
qlin	18	2.44444	1.04162	44.00000	1.00000	4.00000	4
Q12	18	2.72222	1.01782	49.00000	1.00000	4.00000	Q12
013	18	2.94444	1.51356	53.00000	1.00000	5.00000	013
q14n	18	1.88889	0.67640	34,00000	1.00000	3.00000	•
Q15	18	1.66667	0.48507	30.00000	1.00000	2.00000	Q15
016	18	1.44444	0.51131	26.00000	1.00000	2.00000	016
Q17	18	1.61111	0.50163	29.00000	1.00000	2.00000	017
q18n	18	1.88889	0.96338	34,00000	1.00000	5.00000	4
4=0.7		1.00003	0.50550	3,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	2.00000	******	

Cronbach Coefficient Alpha with Deleted Variable Raw Variables Standardized Variables

variable with Total Alpha with Total Alpha Label ffffffffffffffffffffffffffffffffffff
q1n 0.460056 0.906372 0.409026 0.909780 q2n 0.807811 0.893693 0.838966 0.897700 q3 0.712941 0.896360 0.626068 0.903794 0.3 q4 0.634612 0.90188 0.545933 0.90630 Q4 q5n 0.663222 0.898399 0.593803 0.904698
Q4 0.634612 0.900188 0.545933 0.906030 Q4 q5n 0.663222 0.898399 0.593803 0.904698
Q4 0.634612 0.900188 0.545933 0.906030 Q4 q5n 0.663222 0.898399 0.593803 0.904698
Q4 0.634612 0.900188 0.545933 0.906030 Q4 q5n 0.663222 0.898399 0.593803 0.904698
Q6 0.813778 0.894322 0.769885 0.899701 Q6
Q7 0.608783 0.901855 0.693472 0.901888 Q7
g8n 0.527498 0.902923 0.537850 0.906254
Q9 0.438924 0.904751 0.511068 0.906994 Q9
010 0.622939 0.900316 0.638940 0.903431 Q10
glin 0.804767 0.894248 0.812466 0.898470
Q12 0.630203 0.899397 0.569154 0.905385 Q12
Q13 0.740773 0.895543 0.757254 0.900065 Q13
g14n 0.613820 0.901486 0.674389 0.902430
015 0.220368 0.908188 0.318908 0.912201 Q15
0.134597 0.909348 0.253813 0.913925 Q16
017 0.421022 0.905556 0.437862 0.908998 Q17
q18n 0.365543 0.906439 0.333856 0.911802

ANNEXURE B:

```
20
42
2.09473684
-1.0369019
                                                        39.8
0.32363072
    S 105 Pr >= |
Quantiles (Definition 5)
Quantile Estimate
100% Max 5.0
99% 5.0
99% 4.0
75% Q3 4.0
75% Q3 4.0
50% Median 1.0
25% Q1 1.0
5% 1.0
5% 1.0
0% Min 1.0
1.16374269
2.81385942
20.9473684
0.2474866
    variable: Q3 (Q3)

Moments
19 Sum Weights
2.84210526 Sum Observations
1.34425353 Variance
0.01232057 Kurtosis
186 Corrected SS
47.2978093 Std Error Mean
                                                         19
54
1.80701754
-1.1864399
32.5263158
0.30839291
Mean
Std Deviation
Skewness
Uncorrected SS
Coeff Variation
    S 95 Pr >= |
Quantiles (Definition 5)
Quantile Estimate
100% Max 5
99% 5
99% 5
90% 5
75% Q3 4
50% Median 3
25% Q1 2
10% 1
5% 1
10% 1
                      0% Min
```

```
Variable: QS (QS)

Moments
20 Sum Weights
2.4 Sum Observations
1.39170475 variance
0.48944248 Kurtosis
152 Corrected SS
57.9876978 Std Error Mean
            N
Mean
Std Deviation
Skewness
Uncorrected SS
Coeff Variation
                                                                                                                                                         1.93684711
-1.3812132
36.8
0.31119464
                      Basic Statistical Measures

Location Variability

Mean 2.400000 Std Deviation

Median 2.000000 Variance

Mode 1.000000 Range

Interquartile Range
                               Variable: Q6 (Q6)

Moments
20 Sum Weights
2.05 Sum Observations
0.99868334 Variance
0.59621157 Kurtosis
103 Corrected SS
48.7162607 Std Error Mean
                                                                                                                                                        20
41
0.99736842
-0.584652
18.95
0.22331238
            N
Mean
Std Deviation
Skewness
Uncorrected SS
Coeff Variation
Basic Statistical Measures

Location Variability

Mean 2.050000 Std Deviation 0.99868

Median 2.000000 Variance 0.99737

Mode 1.000000 Range 3.00000

Interquartile Range 2.00000

NOTE: The mode displayed is the smallest of 2 modes with a count of 7.
                               Quantiles (Definition 5)
Quantile Estimate
100% Max 4.0
99% 4.0
90% 3.5
75% Q3 3.0
50% Median 2.0
25% Q1 1.0
10% 1.0
5% 1.0
0% Min 1.0
```

```
Variable: Q7 (Q7)

Moments
20 Sum Weights
1.85 Sum Observations
0.67082039 Variance
0.17725815 Kurtosis
77 Corrected SS
36.2605618 Std Error Mean
N
Mean
Std Deviation
Skewness
Uncorrected SS
Coeff Variation
          Basic Statistical Measures
Variability
Mean 1.850000 Std Deviation
Median 2.000000 Variance
Mode 2.000000 Range
Interquartile Range
                                                                                                                                                    0.67082
0.45000
2.00000
1.00000
                   Quantile (Definition 5)
Quantile Estimate
100% Max 3
99% 33
75% 3
90% 37
75% Q3 2
50% Median 2
25% Q1 1
10% 1
5% 1
10% Min 1
                                                     Variable: Q8 (Q8)

Moments
20 Sum Weights
3.7 Sum Observations
1.26074331 variance
-1.1171097 Kurtosis
304 Corrected SS
34.0741434 Std Error Mean
                                                                                                                                                         20
74
1.58947368
0.39508071
30.2
0.28191077
N
Mean
Std Deviation
Skewness
Uncorrected SS
Coeff Variation
           Basic Statistical Measures
Location Variability
Mean 3.700000 Std Deviation
Median 4.000000 Variance
Mode 4.000000 Range
Interquartile Range
                   S 105 Pr >= |
Quantiles (Definition 5)
Quantile Estimate
100% Max 5.0
99% 5.0
90% 5.0
90% 5.0
75% Q3 4.5
50% Median 4.0
25% Q1 3.5
10% 1.5
5% 1.0
0% Min 1.0
```

```
Variable: Q9 (Q9)

Moments
20 Sum weights
1.7 Sum observations
65694669 Variance
30601783 Kurtosis
66 Corrected SS
.6439227 Std Error Mean
        N
Mean
Std Deviation
Skewness
Uncorrected SS
Coeff Variation
                                           0.65694669
0.39601783
66
38.6439227
                                                                                                                 8.2
0.14689774
                Basic Statistical Measures
Variability
Mean 1.700000 Std Deviation
Median 2.000000 Variance
Mode 2.000000 Range
Interquartile Range
                                                                                                               0.65695
0.43158
2.00000
1.00000
                       Quantiles (Definition 5)
Quantile (Definition 5)
Quantile 100% max 3.0
99% 3.0
95% 3.0
90% 2.5
75% Q3 2.0
50% Median 2.0
10% 1.0
5% 1.0
5% 1.0
0% min 1.0
                                           variable: Q10 (Q10)

Moments
20 Sum Weights
2.05 Sum Observations
0.82557795 variance
-0.0982113 Kurtosis
97 Corrected SS
40.272095 Std Error Mean
                                                                                                                 20
41
0.68157895
-1.5184978
12.95
0.18460484
        N
Mean
Std Deviation
Skewness
Uncorrected SS
Coeff Variation
```

```
Variable: Q11 (Q11)

Moments
20 Sum Weights
3.65 Sum Observations
1.03998988 Variance
-0.445291 Kurtosis
287 Corrected SS
28.4928734 Std Error Mean
                                                                                                                                                        20
73
1.08157895
-0.8465008
20.55
0.23254881
N
Mean
Std Deviation
Skewness
Uncorrected SS
Coeff Variation
           Basic Statistical Measures
Location Variability
Mean 3.650000 Std Deviation
Median 4.000000 Variance
Mode 4.000000 Range
Interquartile Range
                    S 105 Pr >= [
Quantiles (Definition 5)
Quantile Estimate
100% Max 5
99% 5
90% 5
75% Q3 4
50% Median 4
25% Q1 3
10% 2
5% 2
10% Min 2
                                                  Variable: Q12 (Q12)

Moments
20 Sum Weights
2.7 Sum Observations
0.97872097 Variance
-0.0673676 Kurtosis
164 Corrected SS
36.2489248 Std Error Mean
                                                                                                                                                        20
54
0.95789474
-0.9636517
18.2
0.21884866
N
Mean
Std Deviation
Skewness
Uncorrected SS
Coeff Variation
           Basic Statistical Measures
Location Variability
Mean 2.700000 Std Deviation
Median 3.000000 Variance
Mode 2.000000 Range
Interquartile Range
                                                                                                                                                  0.97872
0.95789
3.00000
1.50000
                    S 105 Pr >= |

Quantile (Definition 5)
Quantile Estimate
100% Max 4.0
99% 4.0
90% 4.0
75% Q3 3.5
50% Median 3.0
25% Q1 2.0
10% 1.5
5% 1.0
0% Min 1.0
```

```
Variable: Q13 (Q13)

Moments
20 Sum weights
2.85 Sum Observations
1.46089374 variance
0.3997913 Kurtosis
203 Corrected SS
51.2594296 Std Error Mean
N
Mean
Std Deviation
Skewness
Uncorrected SS
Coeff Variation
                                                                                                                                2.13421053
-1.4408809
40.55
0.32666577
          Basic Statistical Measures
Location Variability
Mean 2.850000 Std Deviation
Median 2.000000 Variance
Mode 2.000000 Range
Interquartile Range
                 Variable: Q14 (Q14)

Moments
20 Sum Weights
4.15 Sum Observations
0.67082039 Variance
-0.1772582 Kurtosis
353 Corrected SS
16.1643468 Std Error Mean
                                                                                                                                 20
83
0.45
-0.5481023
8.55
0.15
N
Mean
Std Deviation
Skewness
Uncorrected SS
Coeff Variation
         Basic Statistical Measures
Variability
Mean 4.150000 Std Deviation
Median 4.000000 Variance
Mode 4.000000 Range
Interquartile Range
                Quantiles (Definition S)
Quantile Estimate
100% Max 5
99% 5
97% 5
90% 5
75% Q3 5
50% Median 4
10% 3
5% 3
1% 3
0% Min 3
```

```
Variable: Q15 (Q15)

Moments
20 Sum Weights
1.7 Sum Observations
0.47016235 Variance
-0.9453 Kurtosis
62 Corrected SS
27.6566086 Std Error Mean
                                                                                                                                                          20
34
0.22105263
-1.2418301
4.2
0.1051315
N
Mean
Std Deviation
Skewness
Uncorrected SS
Coeff Variation
            Basic Statistical Measures

Location Variability

Mean 1.700000 Std Deviation

Median 2.000000 Variance

Mode 2.000000 Range

Interquartile Range
                                                                                                                                                        0.47016
0.22105
1.00000
1.00000
                     Quantiles (Definition 5)
Quantiles (Definition 5)
Quantile 100% Max 2
99% 2
95% 2
90% 2
75% Q3 2
50% Median 2
25% Q1 1
10% 15% 1
0% Min 1
                                                       Variable: Q16 (Q16)

Moments
20 Sum Weights
1.45 Sum Observations
0.51041779 Variance
0.2176866 Kurtosis
47 Corrected SS
35.2012266 Std Error Mean
N
Mean
Std Deviation
Skewness
Uncorrected SS
Coeff Variation
           Basic Statistical Measures
Location Variability
Mean 1.450000 Std Deviation
Median 1.000000 Variance
Mode 1.000000 Range
Interquartile Range
                                                                                                                                                        0.51042
0.26053
1.00000
1.00000
                     Quantiles (Definition 5)
Quantiles (Definition 5)
Quantile 100% Max 2
99% 2
95% 2
90% 2
75% Q3 2
50% Median 1
10% 1
10% 1
5% 1
10% 1
10% 1
10% 1
```

```
Variable: Q17 (Q17)

Moments
20 Sum Weights
1.6 Sum Observations
0.50262469 variance
-0.4421236 Kurtosis
56 Corrected SS
31.4140431 Std Error Mean
                                                                                                                                                                                                                                                                                                           20
32
0.25263158
-2.0179739
 N
Mean
Std Deviation
Skewness
Uncorrected SS
Coeff Variation
                                                                                                                                                                                                                                                                                                            4.8
0.1123903
                        Basic Statistical Measures
Location Variability
Mean 1.600000 Std Deviation
Median 2.000000 Variance
Mode 2.000000 Range
Interquartile Range
                                                                                                                                                                                                                                                                                                 0.50262
0.25263
1.00000
1.00000
                                          Quantiles (Definition 5)
Quantiles (Definition 5)
Quantile Estimate
100% Max 2
99% 2
95% 2
90% 2
75% Q3 2
50% Median 2
25% Q1 1
10% 1
5% 1
10% Min 1
                                                                                                         Variable: Q18 (Q18)

Moments
20 Sum weights
4.1 Sum Observations
0.91190951 variance
-2.063644 kurtosis
352 Corrected SS
22.2416953 Std Error Mean
                                                                                                                                                                                                                                                                                                           20
82
0.83157895
6.67257321
15.8
0.20390916
 N
Mean
Std Deviation
Skewness
Uncorrected SS
Coeff Variation
                       Basic Statistical Measures

Location Variability

Mean 4.100000 Std Deviation

Median 4.000000 Variance

Mode 4.000000 Range

Interquartile Range
                                        variable: qln
                                                                                                 varrable: qIn
Moments
20 Sum weights
3 9 Sum Observations
1.44732057 Variance
-0.8494875 Kurtosis
344 Corrected SS
37.1107839 Std Error Mean
                                                                                                                                                                                                                                                                                                          20
78
2.09473684
-1.0369019
39.8
0.32363072
 N
Mean
Std Deviation
Skewness
Uncorrected SS
Coeff Variation
                      Basic Statistical Measures
Location Variability
Mean 3.900000 Std Deviation
Median 5.000000 Variance
Mode 5.000000 Range
Interquartile Range
                                                                                                                                                                                                                                                                                                1.44732
2.09474
4.00000
3.00000
                                       Quantile (Definition 5)
Quanti
                                                                                                                                      variable: q2n
Moments
                                                                                                                                            19
                                                                                                                                                                                           Sum Weights
N
                                                                                                                                                                                                                                                                                                                                                        19
```

106

```
Variable: qSn
Moments
20 Sum Weights
3.6 Sum Observations
1.39170475 variance
-0.4894425 kurtosis
296 Corrected SS
38.6584652 Std Error Mean
N
Mean
Std Deviation
Skewness
Uncorrected SS
Coeff Variation
                                                                                                                                          20
72
1.93684211
-1.3812132
36.8
0.31119464
          Basic Statistical Measures
Location Variability
Mean 3.600000 Std Deviation
Median 4.000000 Variance
Mode 5.000000 Range
Interquartile Range
                                                                                                                                      1.39170
1.93684
4.00000
3.00000
                  S 105 Pr >= |
Quantiles (Definition 5)
Quantiles Estimate
100% Max 5.0
99% 5.0
90% 5.0
75% Q3 5.0
50% Median 4.0
25% Q1 2.0
50% 1.5
5% 1.5
1% 1.0
                                              variable: q8n
Moments
20 Sum Weights
2.3 Sum Observations
1.26074331 Variance
1.11710966 Kurtosis
136 Corrected SS
54.8149264 Std Error Mean
                                                                                                                                       20
46
1.58947368
0.39508071
30.2
0.28191077
N
Mean
Std Deviation
Skewness
Uncorrected SS
Coeff Variation
          Basic Statistical Measures
Location Variability
Mean 2.300000 Std Deviation
Median 2.000000 Variance
Mode 2.000000 Range
Interquartile Range
                                                                                                                                      1.26074
1.58947
4.00000
1.00000
```

```
Variable: qlln
Moments
20 Sum Weights
2.35 Sum Observations
1.03998988 variance
0.445291 kurtosis
131 Corrected SS
44.2548884 Std Error Mean
                                                                                                                                                    20
47
1.08157895
-0.8465008
20.55
0.23254881
N
Mean
Std Deviation
Skewness
Uncorrected SS
Coeff Variation
           Basic Statistical Measures
Variability
Mean 2.350000 Std Deviation
Median 2.000000 Variance
Mode 2.000000 Range
Interquartile Range
                                                                                                                                                1.03999
1.08158
3.00000
1.00000
                   Quantiles (Definition 5)
Quantile 100% Max 4
99% 4
90% 4
75% Q3 3
50% Median 2
25% Q1 2
210% 1
5% 1
0% Min 1
                                                    Variable: q14n

Moments
20 Sum Weights
1.85 Sum Observations
0.67082039 Variance
0.17725815 Kurtosis
77 Corrected SS
36.2605618 Std Error Mean
N
Mean
Std Deviation
Skewness
Uncorrected SS
Coeff Variation
           Basic Statistical Measures
Location Variability
Mean 1.850000 Std Deviation
Median 2.000000 Variance
Mode 2.000000 Range
Interquartile Range
                                                                                                                                                0.67082
0.45000
2.00000
1.00000
                   Quantile (Definition 5)
Quantile Estimate
100% Max 3
99% 3
95% 3
90% 3
75% Q3 2
50% Median 2
25% Q1 1
10% 1
5% 1
10% Min 1
```