

DETERMINANTS OF CLOUD COMPUTING: ADOPTION AND APPLICATION BY HIGH SCHOOL LEARNERS

by

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DECLARATION

I declare that **DETERMINANTS OF CLOUD COMPUTING: ADOPTION AND APPLICATION BY HIGH SCHOOL LEARNERS** is my own work and has not previously been submitted by me for a degree at this or any other tertiary education institution.

I also declare that as far as I am aware, all references used in this thesis have been cited and acknowledged.

N. Nyembezi

Date

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DEDICATION

To my late parents, Liliwe Nyembezi, and Mzuzu Nyembezi who supported me all the way since the beginning of my educational dream. I am continually aware of the good intentions you had towards my achievements and since this expedition is finally completed, you deserve my appreciation - peace be with you.

ABSTRACT

The current study investigated the determinants of Internet services' adoption and use among high school learners in the East London Education District, in the Eastern Cape.

Underpinned by the Unified Theory of Acceptance and Use of Technology, the research questions included: (1) What is the effect of performance expectancy on the learner's intention to adopt and use Internet services? (2) What degree of variation exists for effort expectancy on the learner's intention to adopt and use Internet services? (3) How much of the determinants explain the usage of Internet services? (4) Which is (are) the best predictor(s) of Internet service usage given a set of determinants? (5) What is the effect of confounding variables (if any) on Internet services' adoption and usage? (6) Which model can be designed based on the best predictor(s) of Internet services' adoption and usage for secondary school learners?

A quantitative approach based on the positivist paradigm was used to quantify the relationships among various factors that contribute to Internet services' adoption and use. The research design used was a survey. Data were collected through structured questionnaires. Out of 286 questionnaires issued, the response rate was 40.6%. The study sample size was 116 high school learners using simple random sampling. The data was analysed using the multiple regression analysis technique, and Pearson correlations.

Out of the four determinants from the UTAUT, performance expectancy was the strongest predictor of intention to adopt Internet services. Large positive correlations ranging from $r = 0.638$ up to $r = 0.989$ were found among performance expectancy and effort expectancy variables towards the intention to use Internet services, significant at $p < 0.05$. To enhance the efficiency of the UTAUT model, this study has designed the Adoption and Application of Technology for Learning (AATL) model, which added the price of Internet, persistent use of Internet, and perceptions about Internet use.

Key Terms: Determinants, Internet services, adoption, application, and high school learners.

GLOSSARY OF TERMS

Acceptance of Information Technology: The demonstrable willingness within a user group to employ information technology for the tasks it is designed to support.

Affect: A persons' negative or positive feeling associated with using a particular system.

Anxiety: A persons' emotional reaction when he/she uses a particular technology.

Attitude: A person's feeling (negative or positive) towards using particular technology.

Behavioural Controls: How a person perceives that he/she is able to perform a particular behaviour.

Compatibility: The degree to which a user perceives that he/she has knowledge and resources to use an innovation.

Complexity: The degree of ease associated with an innovation's use.

Construct Validity: The degree to which measured items (measured variables) represent their intended constructs (latent variables).

Content Validity: Content validity involves confidence that items comprising the measuring instrument are representative of the field, which they intend to serve.

Diffusion of Innovation: A process used to convey an innovation among members of a social system via particular channels over specific time periods.

Effort Expectancy: A person's perception that a particular system will be easy to use.

E-learning: The use electronic devices in learning.

Extrinsic Motivation: The degree to which a user perceives that using particular information technology will enable him/her to achieve better outcomes based on external stimuli.

Facilitating Conditions: The environmental infrastructure that makes the

accomplishment of the activity easier.

Innovation: An idea, practice, or object that is perceived as new by an individual or other unit of adoption.

Intrinsic Motivation: Means that the person likes to execute a behaviour because he/she does not have other motivation other than executing the activity him/herself. It is motivation that comes from inside an individual rather than external condition.

Job Fit: The degree to which a person believes that utilizing a technology will enhance his/her work performance.

Long Term Consequences: The degree to which a person believes that he/she would get outcomes by using a particular system in the future.

Observability: The degree to which the results of the experience are clear to other social members.

Outcome Expectations: Outcomes of using a particular information technology.

Outcomes Expectation-Performance: The expectation of the technology used on the job.

Perceived Ease of Use: The degree of complexity of using the technology.

Perceived Usefulness: The degree to which the user believes that using the system will improve his/her work outcome.

Performance Expectancy: A person's beliefs that using a particular system will enhance his/her work performance.

Relative Advantage: The degree to which an individual perceives that an innovation will improve his/her work performance or learning.

Reliability: The extent to which an instrument is without prejudice (bias) and provides consistent measurement across time and variety items.

Self-Efficacy: A person's ability to use the technology to perform particular work.

Social Factors: A user's perception of other people whether or not he/she has to perform a behaviour.

Social Influence: A user's perception of other people whether or not s/he has to perform a behaviour.

Subjective Norm: The degree to which the user believes the importance of opinion of other people as to whether or not s/he uses a technology.

System Flexibility: The degree to which users perceive that they can use the Internet technology from any place at any time.

Traditional Training (face to face training): A training process that takes place when the trainees and trainer are at the same time in the same place.

Trialability: The opportunity of trying a particular system by users before they use it.

Validity: The degree to which the items accurately measure what they are intended to measure.

Voluntariness of Use: The degree to which an individual believes that using a particular technology will be free.

LIST OF ACRONYMS

ANOVA	Analysis of Variance
CANX	Computer anxiety
BI	Behavioural intention
CA	Cronbach's alpha
CAPS	Curriculum and Assessment Policy Statement
CAT	Computer Applications Technology
C-TPB-TAM	Combined Theory of Planned Behaviour and Technology Acceptance Model
df	Degrees of freedom
DoE	Department of Education
EE	Effort expectancy
FC	Facilitating conditions
ICT	Information and Communication Technology
IDT	Innovation Diffusion Theory
IEX	Internet Experience
ISE	Internet Self-efficacy
IST	Information Systems and Technology
IT	Information Technology
MM	Motivational model
MPCU	Model of PC utilization
PE	Performance expectancy
EOU	Ease of use
PBL	Problem based learning
PU	Perceived usefulness
SCT	Social cognitive theory
SE	Standard error
SEM	Structural equation model
SD	Standard Deviation
SF	System flexibility
SI	Social influence
Sig	Significance
SLA	Service Level Agreement

SMS	Short messaging services
SPSS 21	Statistical Package for Social Sciences Version 21
TAM	Technology acceptance model
TPB	Theory of planned behaviour
TRA	Theory of reasoned action
UFH	University of Fort Hare
UNESCO	United Nations Educational Scientific and Cultural Organisation
UTAUT	Unified theory of acceptance and use of technology
WWW	World Wide Web

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CHAPTER 1

BACKGROUND AND RESEARCH PROBLEM

1.0 INTRODUCTION

Although Internet services are becoming increasingly popular as, a way to deliver technology to secondary and higher education environments and other organisations. In a survey conducted in large institutions, half of the respondents in developing countries either have not heard of, or do not know what Cloud computing meant (Burt, 2009). Cloud computing is explained as a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g. external links in applications, mobile connections, open systems network mechanisms, applications interconnectivity and multi-protocol support). All these can be provided rapidly and released with minimal management effort or service provider interaction (Walz & Grier, 2010).

The term Cloud computing describes the software applications or other resources, that exist online and are available to multiple users via the Internet, rather than being installed on a particular user's local computer (Behrend, Wiebe, London & Johnson, 2011). A different approach to Cloud computing is to consider one's experience with email (Chan Gong, Xu & Thong, 2008). "One's email client, if it is Yahoo!, Gmail, Hotmail, and so on, takes care of housing all of the hardware and software necessary to support a person's personal email account" (Walz & Grier, 2010:4).

With the evolution and development of complementary information and communication technologies, Cloud computing has been regarded as a new paradigm for hosting information technology (IT) infrastructure (Zhang, Cheng & Boutaba, 2010). Cloud system adoption assumes that, schools partially or fully replace their landscapes of incumbent systems with Cloud environment (Oracle,

2010). Through leasing outside computing resources, schools avoid up-front investment while reducing their professional risks (Zhang *et al.*, 2010). With the elastic provision of computing resources, Cloud systems can be automatically upgraded and can be flexibly scaled upward and downward (Gill, 2011).

In order to avoid possible risks of system adoption, schools have a tendency to behave conservatively when it comes to new technology and maintain the old systems (Shim, Chae & Lee, 2009). For instance, the associated investments on existing system would hinder the school from chasing new IT innovations. Therefore, identifying the determinants of Internet services' adoption and application has substantial merit for helping researchers, school managers and education authorities to have a better understanding on this growing new IT paradigm.

Fowler and Worthen (as cited in Behrend *et al.*, 2011:231) note that, with its emphasis on the delivery of free applications anywhere, Cloud computing is a promising prospect for educational institutions faced with a number of constraints, including technical, budgetary restrictions and mobile student population. Successful implementation of Cloud computing in educational settings, however, requires careful attention to a number of determinants from both the learner and the school's perspective. The emphasis on the delivery of low-cost or free Cloud computing, the need for Cloud computing in educational settings coupled with the number of constraint determinants, form the crux of the current study. The determinants investigated in this study are performance expectancy, effort expectancy, social influence, facilitating conditions, Internet self-efficacy, Internet experience, and demographic factors.

The first part of this chapter introduced the study; the second part is the background of the problem while the next part explains the objectives of the study, the research questions, and the research hypotheses. The remaining sections are brief overview

of the methodology used, data analysis and the ethical measures followed in the current study.

1.1 BACKGROUND OF THE PROBLEM

1.1.1 Adoption of Cloud Computing

Reviews of literature on technology adoption show that research concerning technology adoption has been done for close to three decades (Agarwal & Prasad, 1998; Davis, 1989; Venkatesh & Davis, 2000; Ochieng, Waema & Onsomu, 2012; Venkatesh, Morris, Davis & Davis, 2003). Most of this research has been carried out in the United States of America, Europe, Australia, Japan and China, but gradually the research on technology adoption is gaining momentum in Africa (Ochieng *et al.*, 2012) and the rest of the developing world.

The South African Department of Education has laid the foundation for Cloud computing at the legislative level. The new CAPS policy document for Grades 10, 11 and 12 learners in South Africa, by the Department of Basic Education (2011: 15) clearly outlines Cloud computing learning outcomes for Computer Applications Technology (CAT) as follows:

- Internet Technologies should teach learners to understand the role that the Internet and the World Wide Web (www) plays as part of the global information super-highway and the contribution towards the digital age.
- Introduce the software involved to render the Internet as a service.
- Understand the concepts of the technologies and standards implemented to enable electronic communication.
- Troubleshoot at an elementary level and find the most workable ways to approach internet problems.

- Understand how technology can benefit specific scenarios.
- Be aware of new trends and developments.

The main question that the researcher asked is whether the adoption of Internet technologies at national level is able to translate to what transpired in the Eastern Cape school where this research was conducted. If not, what are the determinants of Internet services' adoption and use for learners?

The Unified Theory of Acceptance and Use of Technology (UTAUT) is one of the latest developments in the field of general technology acceptance models. Like earlier acceptance models, it explains users' intentions to use information systems technology and to increase usage behaviour. Venkatesh *et al.* (2003) developed this synthesised model from eight earlier models to present a more complete picture of the acceptance process than previous individual models had been able to. The theory holds that four key constructs (performance expectancy, effort expectancy, social influence, and facilitating conditions) are direct determinants of usage intention and behaviour (Venkatesh *et al.* 2003). The research questions and hypotheses of this study are based on these four constructs.

1.1.2 Application of Cloud Computing

Beyond the boundaries of South Africa, there is conflicting evidence that the popularity of short messaging services (SMS) in China is due to the low pricing of SMS relative to other types of mobile Internet applications (Chan *et al.*, 2008). As a result, Chang *et al.* (2008) argue that price value has a significant impact on Cloud computing usage. In Information Systems (IS) research as conducted in educational systems, extrinsic motivation (conceptualised as perceived enjoyment) has been found as having a direct influence on technology acceptance and use (Thong, Hong & Tam, 2006).

A worldwide survey of Gartner Executive Programs reveals that only three percent of Chief Information Officers indicate that they have utilised Cloud computing resources (Gartner, 2011). This means that many schools are still sceptical to adopt Internet services. However, in spite of the potential advantages of Cloud computing, schools hesitate to embrace Cloud systems. They have a concern of accessibility, reliability, security, and vendor lock-in (Gill, 2011). Adopting Cloud systems implies that schools should discontinue current, on-premises systems and shift to the Cloud alternative.

Despite the profound impact of adopting Cloud systems (prepaid or broadband Internet connectivity), theoretical and empirical research pertaining to the internet systems adoption and the factors which affect new users' reaction have been limited and fragmentary in the school context (Saya, Pee & Kankanhalli, 2010).

The determinants investigated in this study were intended to:

- Determine the influence of performance expectancy on the learners' intention to adopt and use Internet services
- Determine the amount of deviation that exists for effort expectancy on behavioural intention.
- Establish how much of the determinants explain the usage of Internet services.
- Determine the best predictor(s) of Internet services' usage, given a set of contributing factors.
- Determine the effect of confounding variables on Internet services' adoption and usage.
- Design a model based on the best predictor(s) of Internet services' adoption and usage for secondary school learners.

This study therefore, measured the effect of various determinants (mentioned in the previous paragraph) on the learners' intention to adopt and use Internet technology.

1.2 STATEMENT OF THE RESEARCH PROBLEM

Internet services answers for schools are not evident and fully explored in the scholarly literature than in business environments though research is clear that integration of disparate systems is critical in improving initiatives of business organisations. Internet services are not fully developed as a platform for information systems in South African schools. Internet services as a derivative of Computer Applications Technology were introduced in South African schools in 2006, but chances of our schools catching up with the developed economies in one big leap, are limited.

There is little, if any, empirical evidence, which shows how effectively performance expectancy, effort expectancy, social influence and facilitating conditions can translate into practice (school situation) in a developing country like South Africa. Hence, this study aimed to investigate the determinants of Internet services' adoption and application among high school learners in the East London district.

1.3 PURPOSE OF THE STUDY

This study was designed to investigate the determinants of Internet services' adoption and application by high school learners in East London.

Having stated the purpose of the study, below are the objectives of the study.

1.3.1 Specific objectives of the study

1.3.1.1 To determine the effect of performance expectancy on the learners' intention to adopt and use Internet services.

1.3.1.2 To determine the degree of variation that exists for effort expectancy on learners' intention to adopt and use Internet services.

- 1.3.1.3 To establish how much of the determinants explain the usage of Internet services.
- 1.3.1.4 To determine the best predictor(s) of Internet services' usage given a set of determinants.
- 1.3.1.5 To determine the effect of confounding variables (if any) on Internet services' adoption and usage.
- 1.3.1.6 To design a model based on the best predictor(s) of Internet services' adoption and usage for secondary school learners.

1.4 RESEARCH QUESTIONS

In order to address the above objectives, the study sought answers to the following questions:

- 1. 4.1 What is the effect of performance expectancy on the learners' intention to adopt and use Internet services?
- 1.4.2 What degree of variation exists for effort expectancy on learners' intention to adopt and use Internet services?
- 1.4.3 How much of the determinants explain the usage of Internet services?
- 1.4.4 Which is (are) the best predictor(s) of Internet services' usage given a set of determinants?
- 1.4.5 What is the effect of confounding variables (if any) on Internet services' adoption and usage?
- 1.4.6 Which model can be designed based on the best predictor(s) of Internet services' adoption and usage for secondary school learners?

1.5 RESEARCH HYPOTHESES

Based on the background, statement of the problem and research questions, the following alternative hypotheses (H_a) and null hypotheses (H_0) are stated:

H_a1: Performance expectancy will affect the learners' intention to use Internet services.

H₀1: Performance expectancy will not affect the learners' intention to use Internet services.

H_a2: Effort expectancy will affect the learners' intention to use Internet services.

H₀2: Effort expectancy will not affect the learners' intention to use Internet services.

H_a3: Social influence plays a positive role on Internet services' adoption and use.

H₀3: Social influence does not play a positive role on Internet services' adoption and use.

Hypotheses 1 - 3 were proposed based on the UTAUT on which this study is founded (*cf.* Chapter 3, section 3.1). The UTAUT was chosen because it has significantly improved over any of the eight original models where the level of significance is around forty percent.

1.6 SIGNIFICANCE OF THE STUDY

1.6.1 To determine the effect of performance expectancy on the learners' intention to adopt and use Internet services

The results of this study could lead to the development of programmes to revitalise e-learning, sensitisation, redirection, and strengthening of Information Systems Technology (IST) to sustain the motivation of e-schools in the East London district of the Eastern Cape. The establishment of e-schools will bring about the benefits (performance expectancy) derived from using Internet services.

1.6.2 To determine the degree of variation that exists for effort expectancy on learners' intention to adopt and use Internet services

The study will contribute to behavioural changes among teachers by emphasising the positive reasons why schools should teach CAT and could serve to review the

current IST programmes used in schools. The significance behind this objective is to highlight the ease (effort expectancy) associated with the use of Internet devices.

1.6.3 To determine the best predictor(s) of Internet services' usage given a set of determinants

After an investigation on various determinants that affect the learners' adoption and application of Internet services, the insights gained from this study might be used to design teacher training (in-service and pre-service). This could help to foster computer use in effective and meaningful ways, which might enhance student learning.

1.6.4 To determine the effect of confounding variables (if any) on Cloud computing adoption and usage

This research has unravelled other mystifying factors that affect Internet services' adoption and use in schools. The formulation of strategies to support teachers and learners has a potential to be expanded to other schools in the province and to significantly improve the quality of teaching and learning in schools. The study could be a springboard for in-depth longitudinal investigations.

1.6.5 To design a model based on the best predictor(s) of Internet services' adoption and usage for secondary school learners

Of equal significance is the issue of educational policy and practice. This research will contribute towards the design of a contextual model for the adoption and application of technology for learning, but will be informed by theoretical development. Thus, the outcomes of this research hold important implications for policy and practice regarding Internet services at the school level.

1.7 RESEARCH PARADIGM

Based on the research questions, this study was anchored on the positivist paradigm (*cf.* Chapter 4). It was the most practical and purely scientific paradigm, which might

have answers to the questions of this research without any ambiguity and controversy.

1.8 RESEARCH APPROACH

Bryman (1988) argued for the 'best of both worlds' approach and suggested that qualitative and quantitative approaches should be combined. Hughes (1997) warns that such techniques underestimate the legitimacy that is associated with choice of methods. In particular, quantitative approaches have been seen as more scientific and objective. For this study, a quantitative approach was used to measure data in order to determine the effect that certain independent variables (performance expectancy, effort expectancy, social influence, and facilitating conditions) have on Internet services' adoption and use. These independent variables also formed the hypotheses of the study as required in any quantitative approach.

The following factors were considered in deciding which approach to use (Punch, 1998:244):

1.8.1 The research questions: The way questions are asked influences what needs to be done to answer them (*cf.* section 1.4)

1.8.2 Is the researcher interested in making standardised and systematic comparisons or want to study the phenomenon or situation in detail?

1.8.3 The literature: How other researchers dealt with this topic? To what extent does the researcher wish to align his own research with standard approaches to the topic?

1.8.4 Practical considerations: Issues of time, money, availability of samples and data, familiarity with the subject under study, access to places, gaining co-operation.

1.8.5 Knowledge payoff: Will we learn more about this topic using quantitative or qualitative approaches? Which approach will produce more useful knowledge

which will do more good?

1.8.6 Style: Some people prefer one to the other. This may involve paradigm and philosophical issues or different images about what a good piece of research looks like.

1.9 RESEARCH DESIGN

Survey design was conducted among Grade 10, 11, and 12 learners where the researcher conveniently selected learners in the East London district. The researcher considered accessibility and the time frame when choosing the respondents. The schools had Grade 8, 9, 10, 11, and 12 and the study targeted a population (N) of 1020 learners. The learners consisted of boys and girls between 13 and 20 years. The researcher determined the sample size by relying on published tables, which provide the sample size for a given set of criteria (Israel, 1992). Hence, 286 respondents were selected randomly. The respondents in the pilot study did not form part of the main study.

1.9.1 Data instrument used

Data was collected by means of a structured questionnaire, where dichotomous questions which require a 'yes' or a 'no' response were asked in conjunction with 4 point Likert scale questions based on Figure 3 in Chapter 3, section 3.1. The questions asked addressed the following:

- (1) The effect of performance expectancy on the learners' intention to adopt and use Internet services.
- (2) The degree of variation that exists for effort expectancy on learners' intention to adopt and use Internet services.
- (3) The extent to which the determinants explain the usage of Internet services.
- (4) The best predictor(s) of Internet services' usage given a set of determinants.

- (5) The effect of confounding variables (if any) on Internet services' adoption and usage.
- (6) A model that can be designed based on the best predictor(s) of internet services' adoption and usage for secondary school learners.

1.9.2 Data Collection Procedure

After being cleared by the university ethics committee a permission to conduct research at the designated school was obtained from the Eastern Cape the Department of Education (see Appendix C). A letter was then hand delivered to the principal of the school informing him of the study and requesting permission to conduct research at the school (see Appendix D). The class teachers selected suitable respondents according to the sampling criteria determined by the researcher. The researcher used stratified random sampling to select 15 learners (from the respondents (*i.e.* 5 learners from Grade 10, 5 learners from Grade 11, and 5 learners from grade 12) for the pilot study. The idea of using senior classes (grades 10, 11, and 12) in high school made it easy to design a literary instrument because the assumption is that learners at this stage can read and write.

The pilot study was conducted before the main study to discover possible weakness, inadequacies, ambiguities, and problems in all aspects of the research so that they could be corrected before the actual data collection was carried out.

1.9.3 Data analysis

Various statistical procedures were applied in the data analysis process, including descriptive and inferential statistics: frequencies, mean, standard deviation, skewness and Pearson correlation coefficient, standardised beta analysis, and one-way analysis of variance (ANOVA).

1.9.4 Reliability and Validity

Jupp (2006:311) defines validity as “the extent to which conclusions drawn from research provide an accurate description of what happened, or a correct explanation of what happens and why”. The researcher maximised the validity and reliability of the data collected by making use of the following close-ended questions in the questionnaire, using clear and simple language in the questionnaire, by clearly explaining the purpose of the questionnaire, and the completion of a pilot study, which resulted in minor adjustments of the original questionnaire.

1.10 ETHICAL CONSIDERATIONS

Onwuegbuzie and Leech (2005) define ethics as moral principles or rules and behavioural expectations of one conducting research. A researcher deals with respondents and these need fair treatment. The following were considered during the course of the research:

1.10.1 Informed consent

Informed consent implies that all possible or adequate information on the goal of the investigation, the procedures which would be followed during the investigation, the possible advantages or disadvantages, the dangers to which respondents may be exposed, and the credibility of the researcher be furnished to potential respondents or their legal representatives (Strydom, 2000:25). Adolescent learners were used in the research. Since these individuals were minors, their parents or guardians acted in loco parentis, for consent to their participation.

1.10.2 Voluntary participation

Participation in the study was voluntary. Respondents were informed about the nature of the study and given a choice to participate or not. Only individuals who volunteered were allowed to participate.

1.10.3 Anonymity and Confidentiality

Anonymity and confidentiality is an individual's right to decide when, where, to whom, and to what extent his or her attitudes, beliefs and behaviour will be revealed (Babbie, 2007). Privacy and confidentiality of participants was guaranteed. The identity of the respondents and the research site were not revealed when reporting the findings. Thus, personal details from respondents remained anonymous.

1.10.4 UFH Higher Degrees Committee

The researcher had to obtain ethical clearance from the Higher Degrees Committee before commencing with the research.

1.10.5 Plagiarism

Using another person's words without giving proper credit is called plagiarism (Creswell, 2003). The researcher acknowledged all sources used to advance this research.

1.11 LIMITATIONS OF THE STUDY

Limitations are used in both qualitative and quantitative studies to identify potential weaknesses of the study (Creswell, 1994).

- The sample size was limited to 116 respondents and the sampling method was convenient and random.
- Validity of this study is limited to the reliability of the instruments used in this study.
- Validity is limited to the honesty of the respondents to the instrument used in this study.
- There may be confounding variables that the researcher fails to control, or eliminate, which may damage the internal validity of this research.
- Content validity might be compromised where respondents have a tendency of answering 'Agree' to most items because it is easy to say 'yes' (even though one does not mean it!) than to say 'no'.

Data collection of this study was limited to three weeks in the month of April 2013.

1.12 DELIMITATIONS

Delimitations are used to address how the study will be narrowed in scope (Creswell, 1994).

This study examined the factors that influence Grade 11 learners to adopt and use Internet services.

The high school learners were chosen from a small township in East London.

The results of the study should not be applied to all secondary schools as other educational environments may lead to different acceptance decisions.

The Internet self-efficacy level of learners is limited to their perceived self-competency technology use level.

1.13 DEFINITION OF TERMS

Cloud computing – is a model for using computers to access information that is processed and sent to large remote web hosts through the Internet (Chang, Duan, Chen, Chen and Huang, 2010).

Application – refers to the use of both the hardware and software to benefit from Internet technology.

High school – According to Pretorius (2007:40) high school refers to “the period of schooling between Grade 8 and 12”. In this study, the same definition is applied.

1.14 CHAPTER DEMARCATION

Chapter 1: Background and research problem. This chapter is an introductory chapter to the research and it sets the tone of the research. This chapter discusses the research that has already been conducted about the topic and cites the shortfalls of that research. Having presented the research problem, the reason for conducting this research is presented and the research objectives and the research hypotheses are stated.

Chapter 2: The review of literature consists mainly of conceptual framework. In this chapter, both primary and secondary literature that has been studied and interrogated is reviewed and the gaps pointed out.

Chapter 3: The theoretical Framework (UTAUT) based on primary and secondary literature will be discussed.

Chapter 4: Methodology. This chapter explains the way in which the research was be conducted based on the research paradigm; the research approach and the research design. The sample used in the study is also discussed. All the tools and procedures used to collect the data are explained. Data collection tools and procedures are also thoroughly explained.

Chapter 5: Data presentation and analysis. In this chapter, all the data collected using the methodology discussed in Chapter 4 will be presented and analysed. The quantitative data is analysed in terms of both descriptive and inferential statistics. In terms of the descriptive statistics, the mean, standard deviation, frequency and dispersion are employed while in terms of the inferential statistics, correlation coefficients, standardised beta and ANOVA are calculated.

Chapter 6: Discussion of findings. In this chapter, all the data presented in Chapter 5 are discussed in conjunction with research questions, literature review, and theoretical framework.

Chapter 7: Summary, Conclusions and Recommendations. The major ideas emerging from the study will be explored further. An overall summary of the achievement of the goal and objectives of the study will be made. While the prescribed guidelines for an effective IST model integration into classrooms will also be suggested. The chapter concludes with some recommendations for future research. Limitations encountered in the research are explicitly stated.

1.15 CONCLUSION

This chapter commenced with an introductory background and rationale for the study. This was followed by problem formulation, the resulting research questions

and research objectives. The researcher's perspective has been described, various relevant concepts defined, research method explained and the planned research programme outlined.

Chapter 2 provides literature review on various aspects of Internet services' adoption and use.

CHAPTER 2

THE REVIEW OF RELATED LITERATURE

2.0 INTRODUCTION

This chapter provides an overview of the currently available information on Internet services. The goal of this chapter is to point out previous research about Cloud computing that overlaps with the topic of this study. According to the research questions, there are several points to be discussed such as Cloud computing in general, the benefits of Cloud computing, issues of Cloud computing, security in Cloud computing and the effect of Cloud computing on school activities. The challenge is also to identify to what extent the literature addresses the gap that has developed between traditional education and Internet education of Cloud computing. Specific themes have been derived from the research questions and the literature review is discussed around these themes.

2.1 CLOUD COMPUTING DEFINED

The term Cloud first emerged in the 1990s, and usually an icon of Cloud has been symbolising the entire Internet networks until today. Amazon's Web-based services began servicing readers since 2000. Later Yahoo and Google began to provide some eminent universities with Cloud computing for the development of new network services since 2006 (Chang *et al.*, 2010). Cloud Computing is simply a concept, but the model can still be operated under highly upgraded Internet bandwidth speed.

In the early stages of Internet, Amazon had huge data centers, which normally use about 8 to 12% of their computing power. The rest was reserved for peak usage. They were the first to provide Cloud computing to the outside world (the customers). This happened in 2006 according to Computer Weekly (2009). Not much later IBM and Google showed interest into Cloud computing and started to invest.

When giving a definition to Cloud computing, the highest hits on Google scholar are used, in particular the ones with the most references regarding Cloud computing. Some scientific papers show up a lot such as (Vaquero, Rodero-Merino, Caceres & Lindner, 2009; and Armbrust, Fox, Griffith, Joseph, Katz, Konwinski, Lee, Patterson, Rabkin, Stoica & Zaharia, 2010).

As a recapitulation, Cloud computing has different definitions. There are definitions that define a Cloud as somehow an updated version of utility computing (Buyya, Vecchiola & Pandey, 2009). The other broader side states that anything one can access outside firewall is Cloud computing, even outsourcing (Knorr & Gruman, 2008). In general Cloud computing provides hardware and software services that are in the Cloud and can be accessed by client as they pay for it. In the “Cloud” means that there is no dedicated hardware reserved in a Cloud providers’ servers.

In other words, Cloud computing is a model for free access of information that flows just like water or electricity supply from water and power plants. Users can simply turn on a tap or install sockets at home, and get water and electricity without water towers or generators (Chang *et al.*, 2010). Besides, the forming of Cloud computing has been created by substantial upgrading of the conveyor of information flows like the Internet to be a new type and evolved ecology of information and communications technology industry. The reason why it is called Cloud computing is, an icon of Cloud within computer system flowcharts usually symbolises the Internet, and computing is processed and sent to large remote web hosts through the internet (*ibid*). To get more into detail about Cloud computing, the components that are used in the Clouds will be discussed.

2.1.1 Cloud computing components

In general there are three main components in Cloud computing, these are the servers, the data centers and the clients (Velte, Velte & Elsenpeter, 2009). They all connect through the Internet with each other and can be seen as a network.

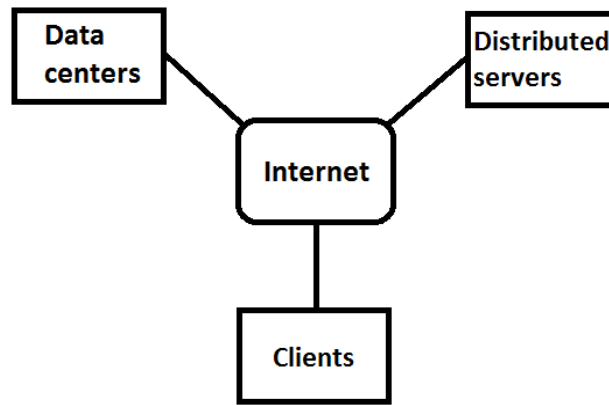


Figure 1: Simple Cloud computing network (Velte *et al.*, 2009)

2.1.1.1 Data centers and Distributed servers

In general the data centers contain the services that clients want to obtain whenever they need it. This center is often a large space which contains all servers providing these services and keeping them up and running (Velte *et al.*, 2009). Distributed servers are a name for those servers that are not all in one location. It does not matter where these servers are, as a user one would not notice the difference. These kinds of servers provide high flexibility because it does not matter where they stand as long as they are connected to the Internet. It is easy for making a back-up of other servers.

2.1.2 Clients

Most general clients are regular desktop PC's or laptops. Other clients nowadays are also mobile phones (Shih, Bahl & Sinclair, 2002). The mobile devices are of big importance for Cloud computing. They provide the high mobility to those who are trying to access the Cloud. In general there are three types of clients to distinguish. These are mobile, thin and thick clients. Mobile clients are those with mobile phones (Velte *et al.*, 2009). Thin clients are using remote hardware and software. What a user sees is visualised by the server and not by an own hard disk with operating

system. On the contrary, thick clients use own hard disks and usually access the Cloud through a web browser.

2.1.3 Users

Logically, behind the clients come the users. Without users, there is no purpose for a Cloud. In Cloud computing Velte *et al.*, (2009) distinguish four different types of users. Internet infrastructure developers; service authors; integration and provisioning experts; and end users.

To point out the differences between the users and for the sake of better understanding of what Cloud computing is, and how it is maintained, all users are explained. Even though for this study the focus lies on the end users (learners), it is important to distinguish these four kinds of users of the Cloud as indicated above.

2.1.3.1 Developers

The Internet-infrastructure developers in the Cloud are those who develop and maintain the Cloud. They have to develop, maintain and guarantee that all services get integrated (Vouk, 2008). Their task is to provide end users with a simple interface, and keeping the complexity at a lower level.

2.1.3.2 Service authors

These authors are somewhat different from the developers but in some cases have overlapping functions. While developers focus on providing all services, authors focus on individual services, which may be used directly. Unlike the developers, they do not need knowledge of technical specifications of the Cloud; they solely focus on providing easy to use services (Vouk, 2008).

2.1.3.3 Integration and provisioning experts

These experts are really more focused on the end-user solutions. They are trying to interface with end users, to meet their needs (Velte *et al.*, 2009).

2.1.3.4 End-users

The end-users eventually have the highest importance as is mentioned before (*cf.* section 2.1.3). End-users expect that their Cloud services have clear and easy to use interface, support and information provision. In addition, the end-users have to be protected from any hazard (Velte *et al.*, 2009). Therefore, it is important to guarantee security in a Cloud, something that will come up later in this study (*cf.* section 2.1.8.1). All these requirements make no difference for the kind of users. Some users may hire Cloud services for hours, and some for years. These different end-users should meet the same service requirements as they might have equally important data streams into the Cloud. The service also depends upon the Service Level Agreement (SLA), which is included in a service contract between two parties. This agreement states what services one party to the other guarantees. It states for example the performance agreements, but also the security and safety agreements.

2.1.4 Layers

Cloud computing consist of several layers that represent the SaaS (software), PaaS (Platform) and IaaS (infrastructure). All three abbreviations end with ... as a Service, meaning that all these layers provide some kind of services to end users (Cloudtweaks, 2010).

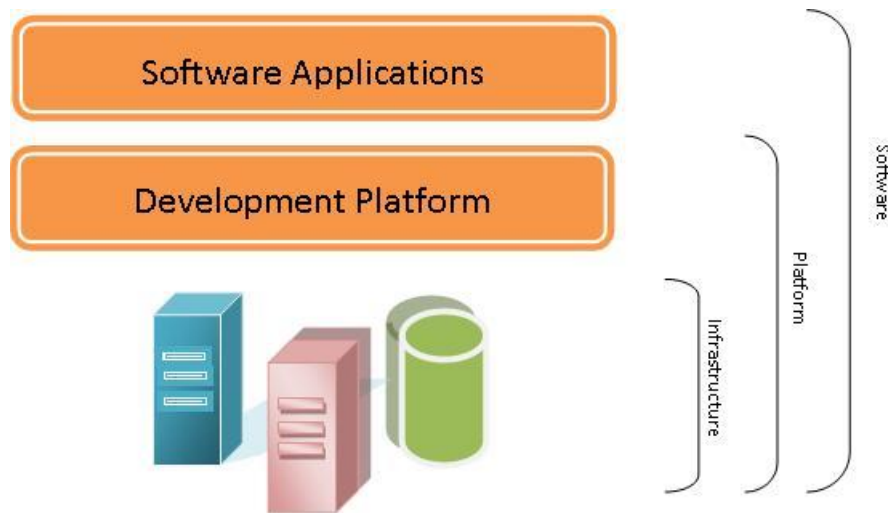


Figure 2: Overview of layers in Cloud Computing (E2E networks, 2010)

The image summarises the tree layers into one picture. To get more into detail the different layers are explained.

2.1.4.1 Software as a Service

SaaS provides software as a service and users can 'rent' the software from the Cloud provider and do not have to purchase software including the licenses themselves. The provider sets the software in the Cloud to be accessible to those who access the Cloud through internet (Vaquero *et al.*, 2009). This form of Cloud computing is gaining popularity and is the most used by end users. Think of services from Google; a lot of people use G-mail, so accessing Google docs is not that far away anymore (Google docs is SaaS). The current research will even be found in Google docs as this software is capable of saving one's document in the Cloud and can be accessed from anywhere in the world. One simply registers to get access to one's own little Cloud. The server hosts the software, in this case the word processor, and besides this, holds the text documents that one writes or uploads. Google provides all these services (for personal users free), so that one does not need to purchase or install a license for a word processing application (Vaquero *et al.*, 2009).

2.1.4.2 Platform as a Service

PaaS differs from SaaS as this service does not provide all the software needed. This is a sort of platform, or a sort of operating system available on the web. The Cloud provider implements scripts from a user and makes it available in the Cloud. This platform service gives the possibility to create, test and maintain applications in the Cloud. Just like SaaS, the provider of the Cloud services is still responsible for any hardware behind the Cloud (Vaquero *et al.*, 2009). Another similarity is the pay-as-you-go system (Mell and Grance, 2009). One pays for using the Cloud. Several types of PaaS can be distinguished (Cloudtweaks, 2010).

The best and most familiar example is Facebook. This is a social application platform. Another example is the huge organisation Amazon, which provides Cloud, computing. This PaaS is called raw computer platform. Other two forms of PaaS are application and business application platforms.

2.1.4.3 Infrastructure as a Service

IaaS provides the school with a complete infrastructure for IT (Vaquero *et al.*, 2009). Clients are able to purchase this infrastructure whenever they want to. It is just like SaaS and PaaS. One pays for what one uses. Moving the infrastructure to the Cloud actually means that the school moves the hardware to the Cloud. A school still needs client computers, but that is all. The rest of mainframes, servers, databases etc. can be obtained from the Cloud.

The infrastructure is the basis and the users actually use the hardware. With platforms, users tend to create and develop applications and with software, the users tend to use the applications only.

2.1.5 Cloud Services Deployment Models

There are four main deployment models in Cloud computing as listed below.

2.1.5.1 Public Cloud

Public Cloud is the traditional and most common way of providing Cloud services, where a Cloud services vendor or a company provides various Cloud services; SaaS, IaaS and PaaS via the internet infrastructure (Armbrust *et al.*, 2010). In this deployment model, the services are visible to everybody and accessible to multiple users at the same time but may not necessarily be free. This model crosses national and regional geographical boundaries. The management and control of the Cloud infrastructure is the responsibility of the company that provides or sells the services.

2.1.5.2 Private Cloud

Private Cloud or internal Cloud or corporate Cloud is a proprietary Cloud architecture that provides hosted services to a limited number of people. It is separated from the Internet or public networks by a firewall and is primarily accessed by end - users of that particular school. It is built, managed, and directly controlled by a single organisation that owns the Cloud infrastructure (Armbrust *et al.*, 2010).

2.1.5.3 Community Cloud

Here, the Cloud infrastructure is shared by several schools that together form the community. The management of the infrastructure may be shared within the school through provision of a common management policy, while in some cases the management and control may be done by a third party on behalf of schools that form the community (Thomas, 2009).

2.1.5.4 Hybrid Cloud

It incorporates components of both public and private Clouds (Babcock, 2010). This is mostly applied where a school builds a private Cloud for the most sensitive or essential services and outsources Cloud services for the non-essential services from a public Cloud (Dustin and Scott, 2009).

2.1.6 Cloud computing compared to other technologies

With the understanding of what Cloud computing is, one might see some similarities to other technologies. This paragraph aims to explain what Cloud computing is, not its differences to those similar looking technologies. Most of these technologies are older than Cloud computing and more familiar to the users. It is therefore important to distinguish them from Cloud computing.

2.1.6.1 Systems of Autonomic Computing

The systems of autonomic computing are normally confused with Cloud computing. This form of computing differs in the way it works. The goal of autonomic computing is to provide systems that work autonomously (White, 2004). This means that they have to be able to do self-managing. They must configure and fix failures themselves. It is similar to Cloud computing because it also consists of large computer systems that have a high-level guidance from humans.

2.1.6.2 Grid computing

Grid computing focuses on large scale whereas Cloud computing provides services for both smaller and larger scale. Grid computing usually provides high performance constantly, and (the major advantage of) Cloud computing provides the performance when necessary (Buyya, 2003).

2.1.6.3 Mainframes

Another comparison is drawn with mainframes. The difference might be clear with a mainframe, but there are also similarities. A mainframe could be seen as a Cloud. Though it is clear that a mainframe provides access to employees in large institutions and the mainframe is completely centralised (Armbrust *et al.*, 2009). The difference with Cloud computing is the performance. Mainframes provide high performance continuously whereas Cloud computing provide high performance when there is a need only.

2.1.6.4 Peer-to-peer systems

The comparison also has been drawn with peer-to-peer systems. This is because there is a whole Cloud of users, which are both clients and servers (Stoica, Morris, Karger, Kaashoek and Balakrishnan, 2002). In Cloud computing clients themselves do not act as providers of any service but at as users. Cloud computing is service oriented but service oriented computing focuses more on techniques that run in the SaaS.

2.1.7 Benefits of Cloud computing

Cloud computing provides various benefits, and the aim of this section is to find out what these benefits actually are. In general, the benefits that are mostly enshrined are for the group of end users. As mentioned before (*cf.* Chapter 2, section 2.1.4.1), the major benefit for any end-user is that, Cloud computing can be used simply whenever one needs it (Kunze, Wang, Laszewski, Younge, He, Tao & Fu, 2008). It is a pay-as-you-go system. The question then why is this actually a benefit? To begin with, the user school has no physical room necessary for all the hardware to install. Furthermore, there are no maintenance costs for all the hardware (Velte *et al.*, 2009).

Besides the hardware, the applications provide benefits. The Cloud is filled with applications that are ready to use, and more important the data used in this application is always accessible from anywhere in the world (Vecchiola, 2009). A Service Level Agreement (SLA) guarantees that quality measures are known before installing a Cloud. These SLAs are important for the users and can be easily maintained when a school purchases all the hardware and software itself.

There is no direct benefit but what is important is that, the data centers are usually placed at strategic chosen places that lower the costs of maintenance. This would be beneficial for low wages countries (Vecchiola, 2009; Shimba, 2010). Scalability is one of the major benefits. When a school is expecting a peak in its IT use, they simply acquire more IT services from the Cloud. This is also the beauty of it because it is very simple. When schools have invested in Cloud computing, the users can also expect a certain degree of security (Velte *et al.*, 2009).

Cloud computing allows schools to scale down or upgrade their resource use as the market or industry conditions shift, and thus endows schools with a “high degree of strategic flexibility” (Jlelalty & Monzer, 2012:16). It increases to-market speed, facilitates space and time savings, remote implementation, mobile business, and is more user-friendly compared to grid systems (Jlelalty & Monzer, 2012). Space savings result from lower physical space requirements since the adoption of Cloud computing translates to less floor space or fewer racks to accommodate machines, servers, and other hardware (Behrend *et al.*, 2011).

2.2 CHALLENGES OF CLOUD COMPUTING

New technologies come with risks and unknown factors something which is not different with Cloud computing. With bad security, schools could be exposed to huge risk as their critical data could be exposed to the outside world. Other challenges have to do to with legal and privacy issues (Sommerville *et al.*, 2010).

(Catteddu, 2009) also makes a distinction between different risks. These risks are divided into four categories, which are the same as those discussed by Sommerville *et al.* (2010). The categories are technical issues (which are the same as security issues), Legal issues as also stated by Sommerville *et al.* (2010), and policy and organisational issues which apply more to the vendors. They are mentioned by as a general category of risks (Catteddu (2009).

Legal issues differ per country but in general, it is expected that not all schools may be allowed to adopt public Clouds. This means that there will be an increase in the use of private Clouds (Sommerville *et al.*, 2010). The privacy and technological (security) issues are briefly discussed in the next section as they apply more to the users of Cloud computing.

2.2.1 Security

The Cloud computing security issues can in general be divided into seven different categories according to Brodtkin (2008). These risks are from the customer's point of view. Risks for providers are not in the scope of this research and therefore not discussed.

The processing of data outside the school brings a certain amount of risk, because in a sense it is a form of outsourcing. This causes a shift of any form of security from the school to the outsourced organisation. It is thus important for the user to be familiar with risk procedures beforehand. The customer (school in this case) is still responsible in the end. The providers have to meet certain standards of security, but these could be of insufficient level for people who want to do harm to the school. Therefore, it is important to know what procedures the provider follows, and it is also important as a client to process the communication between the school and the provider in a secure way.

As a client, one cannot always know where one's information is at a certain time (Velte *et al.*, 2009). This means that they could have their services running in other countries, which have other legal issues. This could result in other security standard for a particular country and jeopardise the school in the Cloud.

There are different organisations in the Cloud; they work all along in that same Cloud. It is not hard to imagine that when fifty different schools access the Cloud it could happen that data are mixed up.

This brings several security issues. For example, not knowing where one's data is physically stored, and what would happen in the case of a natural disaster? The service provider should have a backup when such disasters happen and this should be part of the SLAs. What cannot be checked with Cloud computing is to see who has access from the service provider's side. The service provider determines which users have access; however does not manage access control. Anyone with the login data could access the Cloud of a particular school and access all their data.

2.2.1.1 Security in Cloud computing

There still needs to be a debate regarding issues of security in Cloud computing. Pearson (2009) says that the Cloud should be transparent. All users who want to access the Cloud should provide an explanation of which data they want, how they use it, why they use it etc. Clearly all the behaviour of the Cloud users should be monitored and explained. Without this form of control, data could easily get leaked to competitors.

The users should only have access to information that is necessary for their particular function. No other data should be given except what is required to perform their duties in line with their needs. Data must be limited according to specific actions requirements and be predefined. This boundary limits anyone who tries to do any harm to the school in the Cloud. There should be a link between data and actions to

be made in the system (Pearson, 2009). This would only unblock data that is connected to a certain action in the Cloud. When users want to know something about their own privacy, they should only be able to see information regarding themselves. It is then important that personal information is correct, but also that they cannot access information of other users. The system should have certain functions that check whether the users follow all the standard procedures.

2.2.1.2 Privacy Issues

Privacy is in some way determined by how security is handled; therefore, it is not useful to redefine these issues completely. The privacy issues exist because part of the infrastructure moves to the service provider. Personal data and possibly critical data of schools move around in the Cloud (Pearson, 2009). Because it is out of the viewing range of the school, it is risky as they cannot see who is using the Cloud. They must be assured that security is properly managed, that access is only limited to authorised personnel.

Another point is about how the Cloud is managed. It is important that only certain individuals should know security features in the Cloud and can see all information. Top management needs distinct information than a simple user. Besides that, they need other information provision; it would be risky if any user is able to see the schools' critical information as this could then easily be leaked to the outside world (Pearson, 2009).

2.2.1.3 Cloud computing services in real life

Cloud computing is not only a theoretical technology anymore. Many people are currently using it without even knowing that they do. Talking of social media; Facebook being one of the largest and most widely used social media platform, also uses Cloud computing (Pandey, 2009). In this case, it is Software as a Service. All users of Facebook can use the "Facebook application" for their personal data, but in

essence, they are not able to change anything to this application. The application is in complete control of the service provider, in this case Facebook.

An even better example is Google (Apps) (Pandey, 2009). In this case looking at Google docs in particular in order to point out how convenient Cloud computing can be. In Google drive it is possible to create one's own word, excel or PowerPoint document online. This document is then stored on the server. Any changes made are also stored on this server. The word processor provided by Google is free. Google hosts the word processor for anyone who decides to use it. Besides the convenience of having documents in the word processor online and being accessible from anywhere, it is also possible to share these documents with other people accessing the Cloud. Within the Cloud, a person is able to change another person's document if one has the rights to do so. A person can also access the word processor in the Cloud together with the document one has uploaded and both users can change anything in real-time.

Cloud computing providers such as Amazon or IBM represent larger providers of services. They provide more solutions that are complete and go further than only software as a service. They also provide infrastructure as a service and platform as a service. The two providers mentioned before were mainly focused on free Cloud providing services whereas IBM and Amazon provide more solutions that are complete. Their clients are more concerned with security because they will be processing their core business through Cloud computing.

It is the researcher's contention that the concept of adoption as expressed in the White paper on e-education (DoE, 2003) needs to be unpacked or problematized. In practice, the adoption and application of Internet services is a challenging and complex process for schools, particularly where there is limited previous experience in the use of Information and Communication Technologies (ICTs) to support teaching and learning. Furthermore, at many schools that had access to ICTs, the

focus has tended to be on 'learning about ICTs rather than learning with or through the use of ICTs (Jonassen, Peck & Wilson, 1999).

Historically, the concept of ICT integration as an approach evolved as a reaction to early computer-in-schools programmes where the emphasis was on developing computer literacy or technical knowledge of computers and the use of various computer applications. More recently, ICT integration has been recognised as “using computers to learn, rather than learning to use computers” (UNESCO & COL, 2004:45). Thus, the focus is on adding value to the curriculum in numerous ways. What is important is that ICT skills are not taught as a distinct activity (“just-in-case”), but are acquired “just-in-time,” in the context of activity that is meaningful to learners” (UNESCO & COL, 2004:45). Indeed, “the integrated approach places information technology in a pivotal role in the already transforming learning process. Its success as an approach lies with the ability of teachers to set tasks that require learners to use these information skills. This is appropriate and necessary at this time when South African teachers are being encouraged to adopt new teaching strategies that are outcomes based and learner-centred” (Roos, 2005:21).

This section addresses research questions in relation to review of literature; it starts with:

- (1) What is the effect of performance expectancy on the learners' intention to adopt and use Internet services?
- (2) What degree of variation exists for effort expectancy on learners' intention to adopt and use Internet services?
- (3) How much of the determinants explain the usage of Internet services?
- (4) Which is (are) the best predictor(s) of Internet services' usage given a set of determinants?
- (5) What is the effect of confounding variables (if any) on Internet services' adoption and usage?
- (6) Which model can be designed based on the best predictor(s) of Internet services' adoption and usage for secondary school learners?

2.3 THEMES EMERGING FROM THE RESEARCH QUESTIONS

The following subheadings are the themes from which the literature is reviewed based on the main research questions.

Research question # 1

2.3.1 What is the effect of performance expectancy on the learners' intention to adopt and use Internet services?

Performance expectancy is defined as the degree to which using technology will provide benefits to users in performing certain activities (such as accessibility of Internet services, completing assignments from home instead of staying after school to use laboratory computers) (Venkatesh, Morris, Davis and Davis, 2003).

2.3.1.1 Gaps identified in the literature

2.3.1.1.1 The teacher as “sage on the stage”

This is a limitation, which presupposes the teacher as the source of knowledge dispensing information in neatly packaged parcels to a passive learner engaged in mere absorption (French, Ransom & Bett, 1999:201). Powell and Kusuma-Powell (2007) touch on a number of related issues, which can be perceived as limitations of traditional education. They are proponents of differentiation from the standpoint of the constructivist approach and see differentiation as the key counter to the following perceived limitations. Learners are blank receivers of learning, which must be supplied in pre-packaged lessons. Disjointed rote learning takes place. This form of pedagogy inhibits learners from using technology in the classroom and thereby depriving them of the benefits of using Internet services outside the classroom (Powell & Kusuma-Powell, 2007). The following section reviews the areas that the research question should deal with and the benefits that performance expectancy postulates.

2.3.1.2 Educational implications

The theory used in this study will address the gaps found in literature in the following manner. Powell and Kusuma-Powell (2007) are proponents of effective differentiation in the classroom and counter the teachers' initial fears of differentiation which is seen as leading to the impossible task of accommodating the needs of all learners of varying ability in the classroom. They propose that the teacher develops a deep insight into learners' previous interests, experiences and into the diverse factors influencing learning; the emphasis being on 'knowing your learners'. A suggestion is made that there be a 'repertoire of strategies' to allow for differentiated levels of entry in order for progress to be relevant to the learners' needs and abilities. Where learners are familiar and enthusiastic about using Internet devices, their learning should also be centred on that. A backup support structure should be set up, to keep classroom activities social, which could allow for high performance expectancy on the learners' intention to adopt and use Internet services.

2.3.1.3 The teacher as the all-knowing interpreter of information

This formulation presupposes that pedagogical information delivered by the teacher and interpreted from the teacher's perspective can be matched to the perspective of the learner as receiver. It is an intensification of the role of the teacher as 'sage on the stage', suggesting that the student is denied the opportunity to contribute on the level of cognitive interpretation beyond the teacher's perspective.

This represents a serious limitation as is indicated by the findings of Jonassen, Howland, Marra and Crismond (2008: vi-viii) who refer to the teacher being perceived as all knowing and authoritative in dealing with the world as it exists. In other words, the teacher constructs meaning and interprets it on behalf of the learner who is merely a container of the teacher's views. The learners' interpretation of reality rests at the mercy of the teachers' comprehension. The assumptions of the

role of the teacher limiting the learning experience of learners in the classroom contradict performance expectancy.

2.3.1.3.1 Educational implications

Jonassen *et al.* (2008: vi-viii) suggest a shift in intellectual authority in the classroom that will make the learner a participant in the decisions regarding what it is important to study, how the study should take place and how learners themselves can make a concerted and constructive contribution. The authors maintain that learners play an active role in regulating the way in which their activities are chosen with the emphasis placed on what is important to learn and how they are to go about learning. The implication is that the teacher steps aside and shares management of the teaching situation with the learners.

The potentials of information and communication technology (ICT) as an educational tool in teacher education had been well established by several studies. A study was conducted to investigate the competence and attitude of student teachers towards information and communication technology at the University of Ilorin, Ilorin, Nigeria. Results from the self-report used for the study revealed that student teachers at the University of Ilorin seem to have positive attitude comparable to that of student-teachers in other countries (Yusuf & balogun, 2011). This positive attitude is an important indicator of willingness and first step in effective ICT integration in curriculum. The study also revealed no significant gender difference in their attitude towards ICT.

Yusuf and Balogun (2011) further indicates that the majority of student teachers lack skills in various ICT applications and equipment operations that are important to support and enhance their learning experiences and ICT integration in instruction. Majority of student teachers (over 50%) at the University of Ilorin were not competent in the use of spreadsheets, presentation, database, and web authoring tools; and the

use of peripheral ICT equipment. Generally, this study revealed a significant difference between male and female student teachers in their competence in the use of ICT. Significant differences were established in seven out of 35 items on ICT competence. In addition, male student teachers had higher mean scores for almost all the items on basic ICT competence. This finding is consistent with the findings of previous studies that showed that male students are likely to be more competent than female students in the use of ICT (Derbyshire, 2003).

The following benefits are in line with performance expectancy as the main construct of the UTAUT model (*cf.* section 2.3.1).

2.3.1.4 Benefits derived from Cloud computing in schools

The argument in this section is that the time has come for urgent action to be taken in this step towards Internet based learning. This process does not discard tried and tested techniques but is rather geared towards assimilation of the new with the old in a cooperative relationship.

Motivating teachers to actively adopt the use of Internet services in the learning environment is emphasised by the large number of investigations in the past decade by authors underscoring the need for education to employ emerging technology (Bishop, 2008; Stefanics, 2008; Rounds & Rappaport 2008).

Bishop's (2008:21) study on emerging technology in education mentions the enormous possibilities it offers and emphasises the practicality of teachers placing their notes and/or prepared lessons on the web allowing students to work independently and collectively from any location. It emphasises the storage potential of the web for such material and its availability to future learners. The study refers to a host of multi-media including images, wikis, pages and links, all valuable educational tools. Bishop (2008:21) also indicates opportunity for extended communication not only between the teacher and learner but also between learners

and the linked forums to which they may connect. There is increasing opportunity for learners to interact in the educational process providing the opportunity for regular feedback, updates, information gathering, and dissemination. This allows viewpoints to be exchanged between teachers thereby extending the resources available to them from a shared central web venue.

Since Generation Y students know no other reality than their Internet-based world, they have heightened technical expectations, attitudes, and beliefs regarding library services and research sources (Geck, 2006). More than 90% of them have a computer at home and over 50% have high speed Internet access at home.

Bishop (2008:21) further notes that the classroom has over the years become a very isolated domain and that sharing of ideas and material between classrooms at different schools and between colleagues who are no longer or have never been in geographic proximity to each other is now feasible. Videotaped lessons can be streamed to colleagues elsewhere not only for use in teaching but for their comments and critique. French *et al.* (1999:6) support the view of information dissemination and the retrieval capability of a central web venue as not being limited by location or time of day. There are advantages to be gained by Internet services users moving from the safety of their protected environment and exposing themselves to web options.

2.3.1.5 Teachers as facilitators of information

Jonassen *et al.* (2008: vi-viii) observed that there is consensus in the literature study that in the past decade there has been a major shift in the role of the teacher: from being a source of information from whom learners glean what is necessary for them to be successful in their examinations. Instead, to becoming a facilitator equipped to guide learners to gather information from a multiplicity of sources. This is particularly supported by authors who refer to the responsibility shift, which has taken place from the teacher to the learner in this regard. They perceive this shift as being a possible

source of concern for teachers schooled in the more traditional system. According to Vygotsky's (1978) "zone of proximal development" there is a gap that needs to be bridged between learners' independent achievement and facilitated achievement (Powell & Kusuma-Powell, 2007:57-59).

Rounds and Rappaport (2008:12-16) provide a practical example of an online Problem Based Learning (PBL) environment. PBL entails a process whereby the teacher assumes the role of catalyst to the learning process, while the learner is actively involved in the pedagogic process, in terms of spearheading the learning process, choosing the learning skills and questioning techniques to be applied and playing the role of the driving force in the educational environment. PBL converts the role of the teacher from an active driving force to a supportive facilitator. The Rounds and Rappaport's (2008) study proclaims the advantages of an online PBL approach as equipping learners with the skills required for success in the world of work as the skills required to cope with the online course bring to the fore higher-order thought processes, research, blending of disciplines, self-direction and responsibility.

2.3.1.6 Internet as an instructional tool

French (1999:18-22) stresses the advantage of hypertext links enabling learners to move from one link to another with ease thus facilitating broadening of the knowledge base. French also sees the advantage of learners seeing relationships between aspects of their work while being led through the hypertext links. The fact that members of the study groups who are not in the same geographical area have equal facilities to communicate and are treated equally in the sphere of testing is seen as a major advantage.

Weller (2000:243-252) in his exposition of the advantages of the Internet as an instructional tool highlights the relatively limited production time required for web-based programmes and the added advantage that it can be adapted swiftly and kept updated far more easily than any other materials produced in the learning process.

Furthermore, the quick-fire answer and response capability between a learner and teacher is a benefit to the education process. All learning materials of the past are still applicable to this process yet there is much more scope provided by Internet technology as it is not limited in time, space, place, and/or situation and has the capability for individual and collective instruction. This is supported by Oliver (1999:18) who states that, "The new technologies appear to offer many advantages over conventional formats including economies in cost, greater levels of access to learners, more flexible teaching and learning approaches and enhanced educational opportunities".

In no way is the knowledge base or the traditional role of the teacher threatened or minimised. Internet services are presented as an addition to what the teacher has been equipped with in the past. The teacher embracing Internet services should experience increased job satisfaction through the skills development that the technological exposure will bring.

Powell and Kusuma-Powell (2007) admit that catering for differentiation in the education system could be extremely challenging for the teacher and could drive them back to their traditionally safe methods of teaching. The authors have identified key areas that teachers should address in order to become efficient in this form of delivery namely: a keen awareness of the self and the learner; an in-depth knowledge of the learning material; preparing a wide range of approaches and emphasis on simplicity of delivery and group work, "keeping it social".

Powell and Kusuma-Powel (2007) refer to Vygotsky's (1978) emphasis on the influence of past experience in all areas of life as a frame of reference to be considered if effective teaching is to take place. For example, emphasis on the visual aspects of pedagogy would be emphasised if a child is limited and struggles with reading and writing skills. By "keeping it social", the authors are referring to team teaching and professional coaching.

French (1999:9-24), looks to the future from the perspective of teachers utilising Internet based learning styles to augment present styles. French also foresees learning as an individualised process, self-directed in the sense that the learner will be able to make decisions on the what, how and when of their involvement in the virtual class programme. Particularly, as it is foreseen that the Internet will eventually replace the traditional classroom.

“Just-in-time learning” (French *et al.*, 1999:200) is a process utilised by both the teacher and the learner that allows learning to take place anywhere at any time required by the learner, or the teacher. The authors encourage teachers to match their Internet abilities to the various opportunities for innovation that arise. It is not necessary to be highly qualified in the field initially, they say, as it is possible to begin “by wading in the shallows” (French *et al.*, 1999:2) with simple emails and develop their skill as experience allows.

Stefanics (2008:16) refers to John Couch, who identified three developing trends in education namely: ‘User-created content’ - where learners have created graphics and data for learning. ‘Mobility’ - moveable equipment, such as laptops, iPads, and cell phones. Finally, ‘learning communities’ - communication chat groups and networking sites. Couch downplays the word technology by indicating that it is new only to those who grew up in the pre-computer age.

2.3.1.7 Lifelong learning skills

To move from the classroom to on-line based learning requires courage, self-confidence and belief by the members of the school in the merit of their pedagogy.

Rounds and Rappaport (2008:12-16) argue that amongst the advantages gained from using PBL in an online format are bonding between learners online and a high degree of electronic networking between learners and peers within the various classes. The close relationship that develops between teachers and learners through

Internet services' use allows the teachers to evaluate learners much more effectively and they become much closer to one another than they would have done in a normal classroom situation. Barrows (1988: iii) confirms that a learner-centred approach, once established, allows teachers to reach a degree of closeness to the learners. This approach assists them in assessment but also develops a high degree of respect between teachers and learners. Barrows claims that learners become independent, problem-solvers, and self-motivated. This is an extremely encouraging report, which holds out the probability of Internet services becoming accepted learning means in the future.

Assessing learner achievement will, according to Johnson (1999:184-189), always be difficult. The author, however, maintains that the advantage of online assessment is that there is usually an immediate result, which is communicated immediately to the learner, who has relevant feedback on the spot.

Falloon (2006) mentions that, as computers become available to every learner, it is increasingly possible for the teacher to design learner-centred, on-line study material, matching each learner's needs. Having discussed these benefits of Cloud computing, the learners' performance expectancy might be influenced in a positive way.

Research question # 2

2.3.2 What is the degree of variation that exists for effort expectancy on learners' intention to adopt and use Internet services?

Effort expectancy is the degree of ease associated with learners' use of technology (Venkatesh *et al.*, 2003).

2.3.2.1 Adolescents and Internet services

Lenhart, Purcell, Smith and Zickuhr (2010) found that 93% of teenagers in America, between the ages of 12 and 17 are going online. This number has remained consistent since 2006. Older teens appear to go on the Internet more frequently than younger teens. This could be in line with effort expectancy that gender, age and experience are posited as mediating factors for effort expectancy. Lenhart *et al.* (2010:9) stated:

“Understanding an individual’s technological environment is now a vital clue in understanding how that person uses the Internet, connects with others and accesses information. Among teens, the average person owns 3.5 gadgets out of the five asked in the survey: cell phones, mp3 players, computers, game consoles and portable gaming devices”.

As of September 2009, 75% of adolescents in America own a cell phone. The amount of cell phone use among different adolescent groups (race, ethnicity, gender) is uniform. However, the ways in which females and males use cell phones varied. The computer is also the most frequently used media for adolescents to connect online (Lenhart *et al.*, 2010).

Lenhart, Arafeh, Smith, and Macgill (2008) suggested that location influences the quality of an adolescent’s time spent online. This may include speed of the Internet, time of day online, parental monitoring, and the sites they visit. Perhaps this ownership and location dictates how much one medium is used as compared with another and how much access adolescents may have to various media.

Landline use is more prevalent for conversations with friends while cell phones are used frequently for text messaging. Face-to-face communication and out-of-school interactions actually increase with age (Lenhart, 2009:10).

Cell phone conversations are clearly prevalent in adolescents' daily lives. Not only do they talk on a cell phone but they also send frequent text messages. Face-to-face communication is also common daily occurrence. Adolescents are communicating in multiple ways to connect with their peers and this is the degree of ease that this study wants to ascertain.

In 2006, females were more likely to use social networking sites than males (Lenhart *et al.*, 2010). However, by 2009, there was little difference for use between the two genders. Lenhart *et al.* (2008) found no difference among adolescents who had social networking profiles, based on race, income, or level of parental education.

Today's learners were born during the period of computers, the Internet, and other new media technologies. McMillan and Morrison (2006:89), who studied new media use of college students, found that "participants described older siblings as less skilful at using interactive technologies, while younger siblings were often described as far ahead of participants in their use of the technologies". The age gap that has been identified among technology users in literature needs to be bridged by ensuring that learners are allowed to use the Internet gadgets accessible to them in order to enhance their learning.

Lenhart *et al.* (2008:6) noted, "Teens appreciate the ability to revise and edit easily on a computer, but do not understand that computer usage helps to better their writing skill and improves the quality of their ideas". This research question on effort expectancy seeks to demystify this claim so that proper conclusions are made based on the findings (*cf.* Chapter 6, section 6.2.2).

The Internet is a tool that most adolescents rely on for research. It is reported that more than 90% of adolescents use the Internet. Lenhart *et al.* (2008) found that Internet access is greater with teens from white or high-income families compared to low-income households or groups such as Hispanics.

From the above information, it can be noted that moderators like age, gender and internet experience are regarded as having an effect on the learners' intention to adopt and use Internet services. However, the degree of ease associated with the use of Internet technology (effort expectancy) is tested in Chapter 5, section 5.0.1.2.

Research question # 3

2.3.3 How much of the determinants explain the usage of Internet services?

The following seven sub-sections relate to the gaps that have been identified in the literature as limitations on the adoption and application of Internet services. The results and conclusions drawn from this research question are presented in (Chapter 5 and 6, section 5.2.3 and 6.3.1 respectively).

2.3.3.1 Lack of support for the implementation of e-learning

Falloon (2006) mentions that computers that are available to the teacher are not always matched to the number of learners in a class. Stefanics (2008:16) emphasises the possible problem of school management not supporting the implementation of e-learning and also the inability to supply the necessary teacher coaching.

The researcher believes that this is an extremely critical aspect of the process, which must be addressed in any institution before implementation proceeds. Failure to elicit the support of management could cause either delay or progress of the process. The researcher maintains that once teachers have been exposed not only to the technology but also to the advantages of the technology in their subject areas, they should become self-driven in their quest to effectively introduce Internet services. This should relieve the educational institution of the burden of driving the process.

2.3.3.2 The Digital Divide

Livingstone (2006:221) approaches the term in a new way: As the current study aimed to move from talking about the digital divide to that of digital inclusion, the guiding question must be: What does the public benefit from being digitally included? In relation to this discussion, Jackson, Samona, Moomaw, Ramsay, Lauren, Murray, Smith and Amy (2007) explain that the digital use divide might be more an issue than digital divide. Livingstone and Helsper (2007:690) conclude that, in developed countries, there are very few children, who do not use the Internet: “Even on the basis of a national survey, it is difficult to determine the reasons for low and non-use of the Internet among children and young people, because the sample sizes become very small”.

It is imperative to study the elements existing in society (social influence) before new media and the digital divide because these account for why technology and access are issues in the current debate. Despite age or social status, as more Internet and computer proficiency are acquired, users may have the ability to reach a level playing field at least as far as access is concerned. After examining weak and strong tie relationships, Hampton, Sessions, Her and Rainie (2009) determined that social networking sites, such as Facebook, actually increase social diversity and involvement.

However, Hampton *et al.* (2009:8) found that face-to-face communication does not seem to be suffering. “In-person contact remains the dominant means of communication with core network members. On average, there is face-to-face contact with each tie on 210 out of 365 days per year”.

2.3.3.3 Learning how to learn

Collis and Meeuwsen (1999:25-33) remark that the great expansion of learning opportunities offered by Internet services is not always realised in practice as

learners differ from one another. Some are able to identify and assess information swiftly while others might appear to be slow. The authors refer to the importance of “learning how to learn”. The researcher believes that learners do not receive enough credit for their ability to manage the learning experience productively. It is perhaps because of the passivity expected of the learner in the past that the assumption has been made that the problem of the passive learner also exists widely today.

Furthermore, Jonassen *et al.* (2008: viii) contend that a shift in learner roles is required once management of the learning process becomes a shared process with the teacher. The new learner role - voicing opinions, higher order thinking, self-assessment, and communication - cannot just be presumed to fall within the learner’s sphere of ability. Many learners have been observed to part with educational passivity reluctantly. The study of Jonassen *et al.* (2008: viii) however reveals that it is not normal for learners to turn down the opportunity of extended participation in the education process and that they readily grasp the opportunity to build on their knowledge when offered more participative e-learning.

The question on the extent to which the determinants explain Internet services’ usage has been answered through analysis of price, perceptions, and persistence use in Chapter 5.

2.3.3.4 Loss of the formal classroom

The vanishing formal classroom referred to by Rounds and Rappaport (2008: 12-16) questions the role of the formal classroom system and its related rote learning methodology. The fading role of the formal classroom is important to the future of all forms of education as it gives an intrinsic advantage to Internet learning and provides the space for the new pedagogy or modern education process. The data analysed for demographic characteristics confirmed the Generation Y profile as discussed by Sweeney (2005:165-175), that high school students (as part of Generation Y) value education and training, are technology savvy, format agnostic, and prefer to

collaborate and communicate electronically. The study results also confirmed that respondents primarily used the Internet to search information for school assignments from the convenience of their homes.

Rounds and Rappaport (2008) mention that there is concern where Problem Based Learning (PBL) is implemented because there is a belief based on traditional teaching methods that learners do not learn as efficiently when they are not part of a normal classroom situation. The normal system to which they were accustomed was that learners were only recipients of information and should have the ability to memorise. The PBL system removed this academic crutch and substituted the expectation of research and information gathering and of active interpretation of information. The idea of learning in isolation, which is a new dynamic, placed a previously undemanding system under strain. A new requirement surfaces, namely that the learner be equipped with the desire and ability to take up the challenge of their own metacognition.

The inherent advantage of Cloud computing is that it has the capacity to break down the walls of the classroom and allow educational access to the masses of potential learners.

2.3.3.5 Time consumption

Rounds and Rappaport (2008) mention that the PBL process is time consuming both for learners and teachers. One could agree with this, as this process is much more indirect than the traditional learning process.

The authors however say that it appears that from the learner perspective there has been creativity concerning collaboration in the sharing of tasks. For example learners take responsibility for different tasks and preparation even to the extent of certain learners being freed to deal with the work on certain days as mentioned in Rounds and Rappaport (2008). Amongst learners, a greater level of structure has emerged

by which progress can be monitored along a timeline. It appears according to the authors that the issue of time wastage is adequately countered by the benefits of creativity and a more productively structured education system whereby learners are able to learn anywhere and anytime.

2.3.3.6 The changing role of content, interface, and infrastructure

Harris (1999) maintains that the limitation of the e-learning based approach to education is that, if any one of the three layers of content, interface and infrastructure were to be absent or malfunction, learning would be incomplete. This means that each area should operate optimally for the complete learning experience.

Harris further suggests that e-learning should be so structured that the layers of interface and infrastructure remain an important part of the process but merge unobtrusively into the didactical process. For this to be achieved, the author feels it would be necessary that both teacher and learner be made familiar with the infrastructure and the interface that the point would be reached where these two aspects are secondary to the subject being studied without them being absent from the process.

Internet learning is a more comprehensive means of learning than that found in the traditional system. In this regard, each learning experience content, interface and infrastructure would certainly be present but at varying strengths which is the specific learning experience determining the emphasis to be placed on each of these aspects. With Cloud computing the emphasis is more on the process than on the final result. These determinants have later been consolidated into independent variables or constructs that were incorporated into the UTAUT model.

2.3.3.7 The lack of one-on-one communication and variety

Harris (1999:139-145) maintains that because of one-on-one communication being absent, the lack of human expression could lead to subject material not being interpreted correctly. Another limitation is that this method is mainly founded on reading and writing and this could be regarded as a limitation to learners who are not able to cope with this medium of instruction and who would possibly prefer a visual method of instruction. Finally, Harris refers to the limitation of the material being of a limited variety and not subject to a great deal of change once it has been placed on the web.

Harris' concern about the lack of one-on-one communication is interesting. The researcher however, regards this as an inherent advantage of Internet learning which offers the opportunity of interaction between more than one learner and teacher, thus providing a broader point of view and wider experiential knowledge base. As to the limitation of the variety of information accessed, there is a virtually limitless amount of information available and that, it is only inability or unwillingness that stands in the way of accessing it. In reality, there should be an endless variety of both interactions and learning material.

The author does not provide answers to these problems as such but considers that the newness of this medium of instruction will bring teething problems. Harris is confident that as there is more exposure to these medium, solutions will be found. The teething problems referred to by Harris lead to the question of whether the outcome of the e-learning process matches-up with the expectations of an examination system towards which the outcome of teaching is generally geared. The researcher therefore argues that, the problems mentioned above would require that examinations be restructured, including testing methods for maximum efficiency in implementing the system. It would be to no avail to attempt to match traditional examinations to a non-traditional pedagogical system.

Research question # 4

2.3.4 Which is (are) the best predictor(s) of Internet services?

2.3.4.1 The passive learner versus the active learner

Collis and Meeuwsen (1999:27) state that it is obvious that learners lack the specific “learning to learn” skills. By making use of guidelines gleaned from Collis and Meeuwsen (1999:27) identify five areas where there are shortcomings and which need to be developed in order to expand the “learning to learn” principle. These are, becoming “epistemologists” by beginning to take responsibility for their own thought processes and how information is derived and conclusions drawn.

This research aims to improve learning, by introducing methods (various Internet devices) that could be used to ease the learning process and how to keep the learning process on track. A wide range of study habits and skills should be cultivated, in order to deal with identified information and to achieve best learning results. Linkages between the subject matter being studied and related material from various sources need to be developed, and finally progressing to a stage of self-reflection whereby the learner is able to identify areas of weakness or deficiencies in knowledge, and seek ways to counter these outside the normal examination system.

Collis and Meeuwsen (1999:32) refer to Young (1997:41) suggesting a scaffolding process where learners cross the divide between individualised-learning and assisted-learning. Young identify four strategies. They are opportunities for completing assigned tasks through joint networking with other learners (to counter the negative effect of uninvolved learners). These are opportunities for learners, to think critically when dealing with their assignments and study material, thus increasing learners’ responsibility in planning and carrying out the didactic process necessary to set out procedures and practise clearly.

This research question has been answered in Chapter 5, through the analysis of independent variables using correlation coefficients.

Research question # 5

2.3.5 What is the effect of confounding variables on Internet services' adoption and usage?

2.3.5.1 An imperfect learning environment

The main gap discovered in the literature as a confounding variable that keeps on interfering with learning was lack of perfect learning environment. Harris (1999:139-145) suggests that the traditional didactic system did not lack substance but was limited in terms of the complete learning experience. The traditional passive didactic learning experience is seen as one of the parts of the holistic pedagogical package, which is available.

Harris (1999:139-145) reports, that the Internet allows a holistic learning environment by adding an “interface” and an “infrastructure” which together create a sufficient learning environment. Harris explains that the subject matter must be adapted to suit the didactics but its intention does not change. Interface is the connection between the didactic material and the learner or teacher and the infrastructure layer, which embraces the interface and refers to the computer hardware, software, and Internet service at the disposal of the teacher. These layers form a scaffold for the complete learning environment unavailable in the traditional learning experience.

This study sought to determine other variables, which may adversely affect the relationship between the independent variables and the intention to adopt and use Internet services (*cf.* Chapter 5, section 5.2.5). This may cause the researcher to analyse the results incorrectly. Demographic factors, Internet self-efficacy, and experience of learners in using Internet devices have been examined further in this study using covariance as the measurement tool.

Research question # 6

2.3.6 Which model can be designed based on the best predictors of Cloud computing adoption and usage for secondary school learners?

Education in general has reached a point of no return with pressure to change to a technological based learning system so great that it can no longer be ignored. Even though, the literature speaks of the potential of technology to alienate the learner (Schank & Jona, 1999). The researcher however, argues that Internet services expose the learner and the teacher, to a broader peer audience with which communication can take place.

McCombs (2000) speaks of the transformation of education and the role that e-learning is expected to play in this process. McCombs sees it as the driving force the world needs, which has undergone a fundamental shift in recent times. New technologies have been placed at everyone's disposal and they are available to serve the real needs of the world of work for the learners of the future.

McCombs (2000) emphasises the social aspect referring to schools developing into 'community centers' and learners involved in their communities solving relevant problems. A Cloud computing facility would be seen as a centralising factor for the study, which could then have an extended reach not only locally but also globally. The authors foresee communication between teachers extending across the world. Schank and Jona (1999) suggest that a shift in focus needs to take place from 'gold and standard setting' to utilising top quality technology specialists to design online subject material. Planning for a classroom free, school situation, and conducting experiments that will transform the learning process so that it could be conducted at any place at any time.

McCombs (2000) foresees networked learning communities and acknowledges the importance of security and a supporting environment if Cloud computing is to be conducted successfully on a global basis. Based on the gaps in the existing models,

the study intends to design a model called the Adoption and Application of Technology for Learning (AATL). This model incorporates the price of Internet, perceptions about the use of Internet, and persistent use of Internet would be relevant in a context of secondary school learners.

2.4 CONCLUSION

In order to understand the challenges and the benefits of “new technologies” it was necessary to highlight the dangers of the traditional education system, which has preceded the most modern developments being proposed in this study. This chapter discussed the challenges that exist for education under each research question specifically when introducing Internet services for learning. Those challenges are lack of support for the implementation of e-learning, the Digital Divide, learning how to learn, loss of the formal classroom, time consumption, the changing role of content, interface, and infrastructure and lastly the lack of one-on-one communication and variety.

The researcher has also provided motivation for the implementation of Cloud computing methodology as a solution to these gaps. The following chapter presents an overview of the Unified Theory of Acceptance and Use of Technology (UTAUT) and explains the basic modifications the researcher made to design the Adoption and Application of Technology for Learning (AATL) model (*cf.* chapter 5, section 5.2.6).

CHAPTER 3

THEORETICAL FRAMEWORK

3.0 INTRODUCTION

This section presents an overview of the UTAUT and explains the basic constructs (performance expectancy, effort expectancy, social influence, and facilitating conditions) which are the direct determinants of the user behaviour and behavioural intention (*cf.* section 3.1). It will then provide an in-depth review of the Unified Theory of UTAUT model including its strengths and weaknesses. The framework discusses the proposed constructs added to extend the UTAUT (*i.e.*, perceptions, price, and persistent use) to design the AATL model.

3.1 UNIFIED THEORY OF ACCEPTANCE AND USE OF TECHNOLOGY (UTAUT)

There are numerous theories and models, which information systems researchers use to help predict and explain how and why individuals adopt and use new technologies (Venkatesh *et al.*, 2003). Technology acceptance models focus on an individual's intention to use a new technology as the predictor of usage and technology adoption (Davis, 1989, Davis *et al.*, 1989, Venkatesh *et al.*, 2003). This section provides an overview of the research done on technology acceptance models.

The foundational theory supporting 'intention to use' as a predictor of usage comes from social psychology's Theory of Reasoned Action (TRA) and its extension, the Theory of Planned Behavior (TPB) (Taylor & Todd, 1995). These theories have been used to predict a variety of human behaviours including technology acceptance and adoption (Venkatesh *et al.*, 2003). Davis *et al.* (1989) state that TRA proposes that, a personal performance of a specified behaviour is determined by Behavioural Intention (BI) to perform the behaviour, and BI is jointly determined by the person's

attitude (A) and subjective norm (SN) concerning the behaviour in question ($BI = A + SN$). This means that the strength of people's intention to perform a behaviour is the sum of their positive or negative feelings towards that behaviour plus their perception of how people who are important to them think they should or should not perform the behaviour (Davis *et al.*, 1989).

TPB adds Perceived Behavioural Control to Attitude and Subjective Norm as the core determinants of behavioural intention (Venkatesh *et al.*, 2003). TPB accounts for conditions where individuals do not have complete control over their situation (Taylor and Todd, 1995). In Information System research, perceived behavioural control relates to the perceptions of internal and external constraints on behaviour such as mandatory usage of a new technology in the workplace.

3.1.1 The Basic Assumption of the Technology Acceptance Models

A basic assumption of these technology acceptance models is that individuals' intention to use new technology is a strong predictor of their actual usage (Davis *et al.*, 1989; Han *et al.*, 2004; Jackson *et al.*, 1997; Taylor & Todd, 1995; Venkatesh *et al.*, 2003; Yi *et al.*, 2006). TRA and TPB are foundational theories of the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology Model (UTAUT), which also adopt the assumption that intention is a major influence on behaviour.

The Unified Theory of Acceptance and Use of Technology model was used in this study because it is one of the latest developments in the field of general technology acceptance models. The UTAUT aims to explain user intentions to use Information Systems Technology and increase usage behaviour. Venkatesh *et al.* (2003) developed this synthesized model to present a more complete picture of the acceptance process than previous individual eight models had been able to do. Subsequent validation of UTAUT in a longitudinal study, found it to account for 70% of the variance in usage intention (Venkatesh *et al.*, 2003).

The UTAUT model successfully integrates key elements from eight models previously used in the IS field. These models are the Theory of Reasoned Action, Theory of Planned Behaviour, Technology Acceptance Model, Model of PC Utilisation, Motivational Model, Social Cognitive Theory, Technology Acceptance Model 2, and Diffusion of Innovation. Each of them attempt to predict and explain user behaviour using a variety of independent variables. A unified model was created based on the conceptual and empirical similarities across these eight models.

The UTAUT has four core determinants that influence behavioural intention (BI) to use a technology; these determinants are defined as follows (Venkatesh *et al.*, 2003). Performance expectancy (PE), the degree to which an individual believes that using the system will help him or her to attain gains in job performance. Effort expectancy (EE), the degree of ease associated with use of the system. Social influence (SI), the degree to which an individual perceives that important people believe he or she should use the new system. Facilitating conditions (FC), the degree to which, an individual believes that a school and technical infrastructure exist to support use of the system.

The variables of gender, age, experience and voluntariness of use all work to moderate the impact of the four key constructs on usage intention and behaviour as indicated in Figure 3.

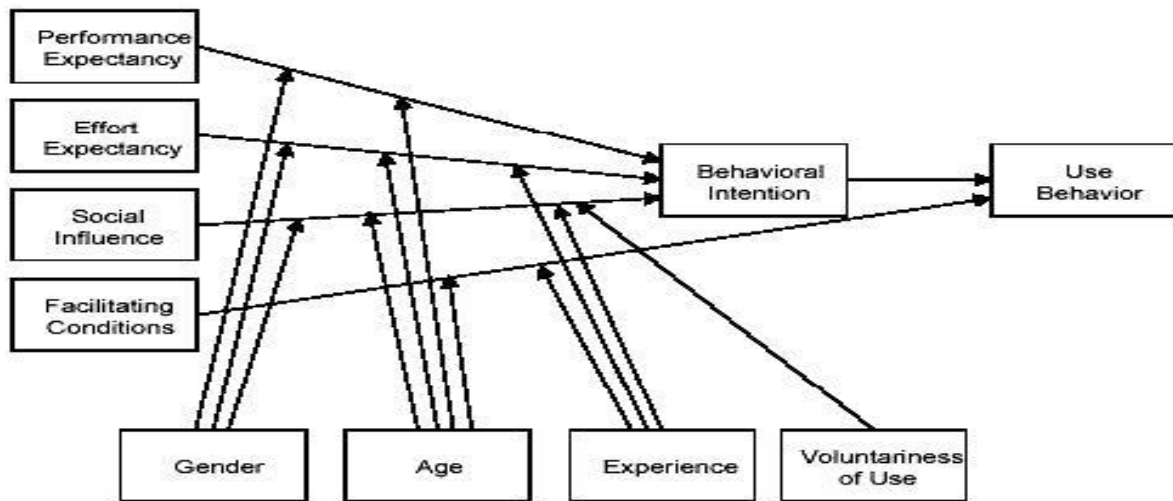


Figure 3: Schematic representation of Unified Theory of Acceptance and Use of Technology (UTAUT) (Source: Venkatesh *et al.*, 2003:447)

3.1.1.1 Previous studies using the UTAUT

Several studies have shown variation in factors that influence behavioural intention and use behaviour towards acceptance and use of new technology. Using the UTAUT, Alawadhi and Morris (2008) investigated the adoption of e-government services in Kuwait and their findings showed that performance expectancy, effort expectancy and peer influence were the determinants of behavioural intention to adopt and use e-government services, whereas facilitating conditions and behavioural intention directly influenced the use behaviour

In addition, Tibenderana and Ogao (2008) found that performance expectancy and social influence were non-significant factors in predicting behavioural intention to accept and use electronic Library services in Ugandan Universities. Further, Adell (2009), while studying driver experience and acceptance of driver support systems established that performance expectancy and social influence had a significant effect on behavioural intention, whereas facilitating conditions directly influenced the use behaviour. Adell (2009) further established that effort expectancy did not have an effect on behavioural intention, unlike in most cases of information technology adoptions.

While examining the behavioural intention towards the adoption and use of Medical Teleconferencing Application, Biemans, Swaak, Hettinga and Schuurman (2005) found that performance expectancy and effort expectancy were the main determinants of behavioural intention while social influence did not play a significant role in determining behavioural intention towards acceptance and use of the medical teleconferencing application.

Pardamean and Susanto (2011), when assessing user acceptance of blog technology using, the UTAUT model established that both social influence and performance expectancy had a significant relationship towards behavioural intention, whereas effort expectancy did not. The study further showed that behavioural intention did not have a significant relationship with actual usage level of blogs as a learning tool. Jong and Wang (2009) studied the student acceptance of web-based learning system and the research results showed that performance expectancy, facilitating conditions and social influence have significant influence towards behaviour intention and additionally, behaviour intention and social influence have direct impact on system usage.

From these studies presented in this section, a conclusion could be drawn that, the results obtained depend solely on the context on which the theory has been applied. Therefore, it is for this reason that the following research questions will be addressed, using the UTAUT in a secondary school context.

3.2 IDENTIFYING CONSTRUCTS INCORPORATED INTO THE UTAUT

Building on the discussion in the introduction, here, the researcher presents an overview of the three constructs added to the UTAUT and discusses the details of the three constructs. The researcher adopted an approach that complements the current constructs in the UTAUT. First, the Adoption and Application of Technology for Learning (AATL) takes an approach that emphasises the importance of extrinsic motivation among learners. The construct tied to usefulness namely performance

expectancy and has consistently been shown to be the strongest predictor of behavioural intention (Venkatesh *et al.*, 2003). Complementing this perspective from motivation theory is intrinsic motivation (Vallerand, 1997).

Finally, UTAUT and related models hinge on intentionality as a key underlying theoretical mechanism that drives behaviour. Many, including detractors of this class of models, have argued that the inclusion of additional theoretical mechanisms is important. In a use, rather than initial acceptance, context habit has been shown to be a critical factor predicting technology use (Kim & Malhotra, 2005). Based on the above gaps in UTAUT and the associated theoretical explanation provided, the researcher has integrated persistent use, perceptions, and price of Internet, into UTAUT in order to tailor it to the school context (AATL). The UTAUT model (based on the earlier eight models) was a springboard from which the modified contextual model (AATL) was formed (*cf.* Chapter 1, section 1.4.1 to 1.4.5).

3.3 VARIOUS MODELS THAT CONSTITUTE THE UTAUT

For the understanding of the acceptance and adoption of information technology, Vankatesh, *et al.* (2003) has proposed a more complete model, Unified Theory of Acceptance and Use of Technology (UTAUT) model. The UTAUT model integrated the elements of various prominent technology acceptance models namely Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), Motivational Model (MM), Theory of Planned Behaviour (TPB), Combined TAM-TPB, Model of Personnel Computer (PC) Utilisation (MPCU), Innovation Diffusion Theory (IDT), and Social Cognitive Theory (SCT).

The integration of all these models to form a unified model helped in unpacking the constructs that determine the learners' behavioural intention towards Internet services' adoption and application. These constructs addressed research question one to six as follows:

3.3.1 Learners' Demographics adapted from the Theory of Reasoned Action (TRA)

The current study has theorised learners' demographics as confounding variables, and research question five sought to address this concern.

As Theory of Reasoned Action (Fishbein & Ajzen, 1975) states, individual performance of a given behaviour is primarily caused by a person's intention to perform that behaviour. The intention in turn is influenced by two major constructs, namely attitude towards the behaviour and subjective norm. In the context of attitude towards the behaviour, it is an individual's positive or negative feeling about performing the target behaviour. On the other hand, subjective norm is regarded as "the person's perception that most people (peers of the same gender) who are important to him think he should or should not perform that behaviour in question" (Fishbein & Ajzen, 1975). Learners' demographics were investigated in this research and gender was found to have a significant influence on the learners' behavioural intention to adopt and use Internet services (*cf.* Chapter 5, section 5.2.5). Davis, Bagozzi, and Warshaw (1989) applied TRA in their study on user acceptance of computer, focusing on the use of electronic mail, and they found that usefulness had significantly greater correlation with usage behaviour than did ease of use.

The TRA is less specific than the IDT in its identification of the perceptions affecting behaviour. Rather than starting with a predefined set of perceptions, Ajzen and Fishbein (1980) suggest eliciting five to nine salient perceptions (beliefs) in order to determine the specific behavioural beliefs applicable to the specific behaviour.

3.3.1.1 Performance Expectancy adapted from the Innovation Diffusion Theory (IDT)

According to Rogers (2003), the reason for increased dwelling interest in the diffusion of innovations is that, getting a new idea adopted, even when it has obvious advantages, is very difficult (Rogers, 2003). The main concerns of the innovation

diffusion research, centres on how innovations are adopted as well as the reasons behind innovations adopted at different rates. Rogers (2003) goes on stating that there are four main elements of diffusion - innovation, time, communication, and social system. Expanding from the four main elements, Rogers explains diffusion as the process by which an innovation is communicated through certain mediums over a certain period among the members of a social system (Rogers, 2003).

The IDT posits that certain attributes of innovation, as perceived by individuals, help to explain their different rates of adoption. Rogers (2003), defines these attributes as:

(a) Relative advantage – “the degree to which an innovation is perceived as better than the idea it supersedes. The degree of relative advantage may be measured in economic terms, but social prestige factors, convenience, and satisfaction are also important factors.”

(b) Compatibility – “the degree to which an innovation is perceived as being consistent with the existing values, past experiences and needs of potential adopters. An idea that is incompatible with the values and norms of a social system will not be adopted as rapidly as an innovation that is compatible.”

(c) Complexity – “the degree to which an innovation is perceived as difficult to understand and use”.

(d) Trialability – “the degree to which an innovation may be experimented on a limited basis. New ideas can be tried on the instalment plan and will generally be adopted more quickly than innovations that are not divisible.”

(e) Observability – “the degree to which the results of an innovation are visible to others. The easier it is for individuals to see the results of an innovation, the more likely they are to adopt.” Several authors’ note that relative advantage, compatibility and complexity are the three most used attributes in relation to

adoption of innovation (Baraghani, 2007).

Moreover, Karahanna, Straub, and Chervany (1999) adapted the characteristics of innovation diffusion theory in evaluating the differences in pre-adoption and post-adoption of Windows 3.1 software. This evaluation is by analysis using terms of beliefs and attitudes. In order for technology to be diffused successfully, the keys are that it must be reliable, easy to use, and compatible with today's advances. The success of any new technology at all, is solely dependent on how people and users are being able to accept and use it. Without that, any technology, new or old will be useless.

Research question # 1

3.3.2. What is the effect of performance expectancy on the learners' intention to adopt and use Internet services?

The performance expectancy construct within each individual model is the strongest predictor of intention and remains significant at all points of measurement in both voluntary and mandatory settings consistent with previous model tests (Venkatesh & Davis, 2000). However, from a theoretical point of view, there is reason to assume that the relationship between performance expectancy and intention will be moderated by *gender* and *age*. Research on gender differences indicates that men tend to be highly task-oriented (Minton & Schneider, 1980) and, therefore, performance expectancies, which focus on task accomplishment, are likely to be salient, especially to men. Gender schema theory suggests that such differences stem from gender roles and socialisation processes reinforced from birth rather than biological gender per se (Lynott & McCandless, 2000).

3.3.2.1 Effort Expectancy adapted from the Theory of Planned Behaviour (TPB)

Consecutively, Theory of Planned Behaviour (TPB) of Ajzen (1991) relates to how the behaviour of people changes. Briefly, according to TPB, there are three kinds of considerations, namely attitude towards behaviour (adapted from TRA), subjective norm (adapted from TRA) and perceived behavioural control. What perceived behaviour control means is the perceived ease or difficulty of performing the behaviour (Ajzen, 1991). As a general rule, the more favourable the attitude and subject norm and the greater control, the stronger should be the person's intention to perform the behaviour in question (Ajzen, 1991).

Based on the TPB, this study has identified effort expectancy as one of its main constructs that could affect learners' intention to adopt and use Internet services. Moreover, effort expectancy has formed research questions number two and hypotheses statement number two for this study.

Research question # 2

3.3.2.2 What degree of variation exists for effort expectancy on learners' intention to adopt and use Internet services?

Effort expectancy is the degree of ease associated with learners' use of technology; From Figure 3, gender, age and experience are posited as mediating factors for effort expectancy, which further affect computer self-efficacy and computer anxiety. From the perspective of effort expectancy in school settings, learners assess time and effort in forming views about the overall effort associated with the acceptance and use of technologies. In an educational context, price is also an important factor, unlike workplace technologies, learners have to bear the costs associated with the purchase of devices and services. Consistent with this argument, much consumer behaviour research has included constructs related to cost to explain consumers' actions (Dodds, Monroe & Grewal, 1991). However, the researcher has adapted the AATL to explain the learners' actions.

3.3.2.3 Social Influence adapted from the Technology Acceptance Model (TAM), and TAM2

An extended explanation also came about through Technology Acceptance Model (Davis, 1989), which attempts to offer a prevailing explanation for user acceptance and usage behaviour. To start, TAM is an adaptation of TRA that is specific for modelling user acceptance of information system. User acceptance in TAM is controlled by two key beliefs, perceived usefulness and perceived ease of use. Explanation for perceived usefulness is the extent to which a person believes that using a particular technology will enhance her/his job performance. Alternatively, perceived ease of use is defined as the degree to which a person believes that using a technology will be free from effort (Davis, 1989).

It is interesting to note that, TAM2 was extended from TAM by including subjective norm as an additional predictor of intention (Venkatesh & Morris, 2000). Subjective norm involves an individual's belief that people who are important to her/him think she/he should perform the behaviour in question as defined by Fishbein and Ajzen (1975). Venkatesh and Morris (2000) in their research constructed the basis for the integration of gender as potential key in understanding the role of social influence in initial technology adoption decision including sustained usage of new technology. Although social influence did not form part of the research questions, it was hypothesised that, social influence has a positive role to play in Internet services' usage. The results of this variable are discussed in Chapter 5, section 5.3.3.

The Technology Acceptance Model is indeed a very popular model for explaining and predicting system use (Chuttur, 2009). Several social psychology researchers have replicated Davis (1989), original model, to show the relationship between ease of use of a system, perceived usefulness of a system and the actual system use. Venkatesh and Davis (2000) introduced a unified model by introducing social influence as a factor that can influence the perceptions of the user.

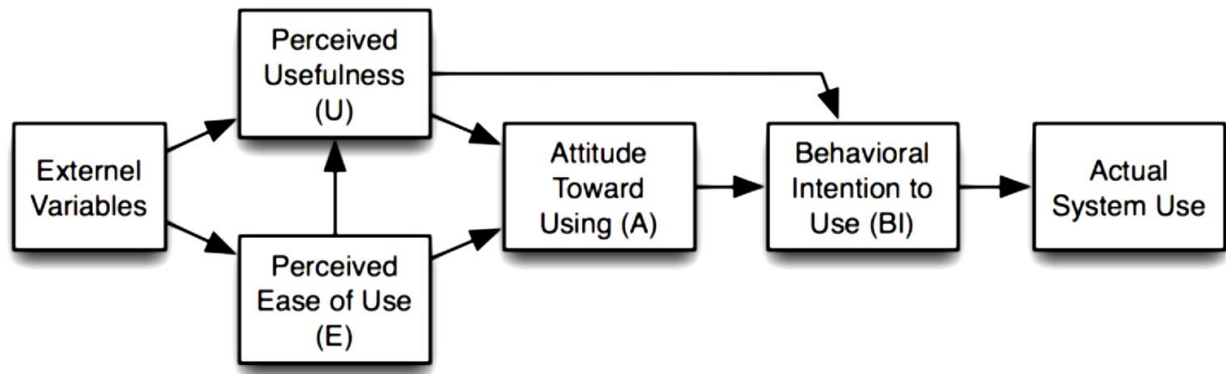


Figure 4: Technology Acceptance Model - Source: (Davis 1989:985)

The researcher has also included perceptions about Internet use as an influential factor on the learners' intention to adopt and use Internet services. The results of such effect are discussed in Chapter 5 under research question four.

Research question # 3

3.3.2.4 How much of the determinants explain the usage of Internet services?

The enjoyment and satisfaction derived from using a technology, has been shown to play an important role in determining technology acceptance and use (Brown and Venkatesh, 2005). In information systems research, such perceptions (conceptualised as perceived enjoyment) has been found to influence technology acceptance and use directly (van der Heijden, 2004). In the consumer context, perceived enjoyment derived has also been found to be an important determinant of technology acceptance and use (Brown & Venkatesh, 2005). Thus, this study has theorised perceptions as a predictor of learners' behavioural intention to use technology for the learning purpose (*cf.* Chapter 5, section 5.2.6).

Research question # 5

3.3.3 What is the effect of confounding variables (if any) on Internet services' adoption and usage?

It has been noted that the gender differences on behavioural intention could be driven by cognitions related to gender roles (Lynott & McCandless, 2000). Increased age has been shown to be associated with difficulty in processing complex stimuli and allocating attention to information when using technology (Plude & Hoyer, 1985), both of which may be necessary when using software systems. Prior research supports the notion that constructs related to the ease of using technology will be stronger determinants of individuals' intention for females (Venkatesh & Morris 2000; Venkatesh *et al.*, 2000) and for older users (Morris & Venkatesh, 2000).

3.3.4 Experience adapted from the IDT phases of adoption

This research has theorised experience as a confounding variable, and research question five sought to address this concern. The modified theory for adopting information technologies (Moore & Benbasat, 1991) includes seven attributes that influence the adoption of an innovation: Compatibility, Relative Advantages, Ease of Use, Result Demonstrability, Image, Visibility, Trialability, and Voluntariness. Rogers (2003) also describes five phases that a person goes through when adopting a new technology. In this study, the learners who were investigated, went through the following decision process. Rogers calls this the innovation-decision process:

- (a) Knowledge
- (b) Persuasion
- (c) Decision
- (d) Implementation
- (e) Confirmation

The process starts when the individual gets information about the innovation. Rogers describes this with the word Knowledge. The second phase of the process,

Persuasion, occurs when an individual forms an attitude, positive or negative, towards the innovation. Already in this stage, the technology becomes favourable or unfavourable for the user. In the third step, the individual decides if he or she wants to use the innovation or not. The fourth phase is Implementation and in this phase, the innovation is put into practice. In the last phase, Confirmation, the individual strengthens his or her decision to adopt the product, reduce the use of the product, or discontinue use of the product (West, Waddoup & Graham, 2006).

West *et al.* (2006) identified patterns in the fourth phase, Implementation, of Rogers' Diffusion of Innovations model when implementing it to education. The five proposed phases of implementation are as follows:

- (a) Experimentation
- (b) Technical Challenges
- (c) Integration Challenges
- (d) Increased Comfort Level
- (e) Adaptation.

The first phase of Implementation is Experimentation. When adopting the innovation the user starts to experiment with the technology. The Experimentation is usually self-learning. The user tries to find out what the different applications do. Both Rogers (2003) and West *et al.* (2006) discovered that a user does not start using all features of a system in the beginning of adoption. This is called trialability as users test the system with a couple of features. After the early experimentation, the individual will face some Technical Challenges. The Technical Challenges (persistent use) include usage over time and the effectiveness of the innovation. After overcoming the Technical Challenges, the individual will face Integration Challenges. Most individuals know how to use new devices or learn to use them fast, but they do not know how to integrate them into a learning context. The fourth phase is naturally Increased Comfort Level (experience) after the challenges have been overcome. In the last phase, with an Increased Comfort Level, the user can adjust the innovation and a re-invention of some features occurs. The phases in the

implementation process do not have to happen in a linear order, they can also overlap.

After the implementation process, the user makes a decision of whether to continue using the new technology. The decision is based on how well the implementation process proceeds and how the person adopts the new technology, in this case the online learning environment.

West *et al.* (2006) found three different outcomes that the user decides to do after the implementation process: continuation, reduction, or discontinuation. The continuation decision means that the user finds the technology useful and starts using it in work. Reduction implies that the user chooses to use the technology but only when necessary. The user does not feel committed to the technology and can try new ones. The third option, discontinuation, is that the user does not start using the product.

West *et al.* adapted version of Rogers' innovations process is used in the analysis of this research. The whole process from Knowledge to Confirmation is illustrated below:

1. Knowledge

2. Persuasion

3. Decision

4. Implementation

- a. *Experimentation*

- b. *Technical Challenges*

- c. *Integration Challenges*

- d. *Increased Comfort Level*

- e. *Adaptation*

5. Confirmation

The researcher observed that the UTAUT has relied heavily on IDT, and the researcher has proposed persistent use (which later results to habit and experience) as an additional construct to the UTAUT model. This variable has also been under scrutiny in Chapter 5 (*cf.* section 5.2.5.3) for its correlation to the use of Internet services and the ANOVA results found it to have an insignificant influence towards the use of Internet services.

3.3.4.1 Development of the hypothesised model (AATL)

In this section, the researcher presents the four hypotheses that were incorporated to extend UTAUT to the school context. Figure 6 in Chapter 5 shows the original UTAUT and the proposed modifications.

3.3.5 Internet Self-Efficacy adapted from the Social Cognitive Theory (SCT)

This research has theorised Internet self-efficacy as a third confounding variable, and research question five sought to address this variable. Overall, Bandura's Cognitive theory (1986) explains the relationship between a person's behaviour, personal factors such as cognitive skills or attitudes, and the environment. Each can influence and be influenced by the other, or it influences one another. Social cognitive theory is a view that, individuals possess self-beliefs that enable them to exercise a measure of control over their thoughts, feelings, and actions, "What people think, believe, and feel affects how they behave" (Bandura, 1986:25). With that, Bandura presents a view of human behaviour in which the beliefs that people have about themselves are key functions in the exercise of control. So goes the saying "No man is an island", as human lives are not lived in isolation, people work together on shared beliefs about their capabilities and common aspirations to better their lives. Thus, environments and social systems influence human behaviour on an enormous scale.

This study has definitely borrowed from SCT, by seeking to determine the ability of each learner to use Internet services skilfully. Fifteen questions, which required a 'yes', or a 'no' were asked in a form of questionnaire (cf. Appendix E). The Internet self-efficacy also happened to be a variable that played a significant role in the use of Internet services (cf. Chapter 5, section 5.2.5.2). Thus, the researcher hypothesised:

H1: The Internet self-efficacy will moderate the effect of behavioural intention on use of Internet services to enhance learning.

Research question # 6

3.3.6 Price of Internet adapted from the Motivational Model (MM)

According to Brown and Venkatesh (2005), intrinsic motivation is a conduct that deals with the environment, and tends to motivate a person's need to be competent and self-determined. This intrinsic motivation will decrease if the person is not attaining enjoyment from the activities. Extrinsic motivation activities link extrinsic rewards, which consequently correlated to satisfaction of primary drives of achieving goal set. An example of positive rewards can be money, praise, social approval, or positive feedback for fitting into one's social reference group. The only things that could deter the learners from attaining intrinsic motivation are the costs involved in acquiring Internet devices and getting them connected. As a result, this study has explored the effect of price of Internet on the use of Internet devices by learners (cf. Chapter 5, section 5.2.6).

3.3.6.1 Price incurred for Internet access

An important difference between a consumer use setting and the business use setting, where UTAUT was developed, is that the users usually bear the monetary cost of such use. The cost and pricing structure may have a significant impact on the use of Internet services by learners. For instance, there is evidence that the

popularity of short messaging services (SMS) in China is due to the low pricing of SMS relative to other types of mobile Internet applications (Chan *et al.*, 2008). This study follows the idea of *price* as learners' cognitive trade-off between the perceived benefits of the applications and the monetary cost for using them. The price is positive when the benefits of using Internet services are perceived to be greater than the monetary cost and such price has a positive impact on intention. Thus, the researcher hypothesised:

H2: The price of Internet access will moderate the effect of behavioural intention on use of Internet services to enhance learning.

3.3.6.2 Persistent Use adapted from the Model of PC Utilisation (MPCU)

Further, Thompson, Haggins, and Howell (1991) in their research to predict usage behaviour in personal computer utilisation, relied heavily on their research Model of PC utilisation. Among the core constructs in the Model of PC utilisation are job fit, complexity, long-term consequences, and effect towards use, social factors and facilitating conditions. In short, job fit is the extent to which individuals believe that using a PC can enhance their job performance (Thompson *et. al.*, 1991). Additionally, complexity is the degree to which an innovation is perceived as relatively difficult to understand and use, based on Rogers (1995).

This study was influenced by MPCU in that, it sought to establish the effect of persistent use on the learners' intention to adopt and use Internet services. The research question number three sought to establish the extent to which the determinants explain the usage of Internet services. Due to this, a questionnaire, which consisted of three questions regarding persistent use, was developed (see Appendix E).

3.3.7 Persistent Use

Persistent use has been added to the UTAUT. Prior research on technology use has introduced two related yet distinct constructs, namely *experience* and *habit*. Experience, as conceptualised in prior research (e.g., Kim and Malhotra, 2005; Venkatesh *et al.*, 2003), reflects an opportunity to use a target technology and is typically operationalised as the passage of time from the initial use of a technology by an individual. Venkatesh *et al.* (2003) operationalised experience as three levels based on passage of time. Post-training was when the system was initially available for use; 1 month later, and 3 months later. Persistent behaviour has been defined as the extent to which people tend to perform behaviours automatically because of learning (Limayem, Hirt and Cheung, 2007), while Kim, Malhotra and Narasimhan, (2005) equate habit with automaticity.

Although conceptualised rather similarly, habit has been operationalised in two distinct ways: first, habit is viewed as prior behaviour (Kim and Malhotra 2005); and second, habit is measured as the extent to which an individual believes the behaviour to be automatic (Limayem *et al.*, 2007). Consequently, there are at least two key distinctions between experience and habit. One distinction is that experience is necessary but not a sufficient condition for the formation of habit. A second distinction is that the passage of chronological time (i.e., experience) can result in the formation of differing levels of habit depending on the extent of interaction and familiarity that is developed with a target technology. For instance, in a specific period, of four months, different individuals can form different levels of habit depending on their use of a target technology. This is perhaps what prompted Limayem *et al.* (2007) to include prior use as a predictor of habit; and likewise, Kim and Malhotra (2005) controlled for experience with the target technology in their attempt to understand the impact of habit on technology use. Infusing experience and habit together, this study added persistent use as an important factor to be considered when studying learners' actual use of Internet services. Thus, the researcher hypothesised:

H3: Persistent use of the Internet will moderate the effect of behavioural intention on use of Internet services such that the effect will be stronger for learners with high levels of experience with the technology.

3.3.8 Perceptions about Internet Use adapted from Analysis of the TAM

Some studies, found the original TAM to be one of the most effective and efficient models available for measuring behavioural intention (Legris *et al.*, 2003; King and He, 2006).

One interesting finding by several of the summary literature articles was that the correlation between Perceived Usefulness and Behavioural Intention is strong, the correlation between Perceived Usefulness and Perceived Ease of Use is strong, but the correlation between Perceived Ease of Use and Behavioural Intention is weak (Ma and Liu, 2004). If Perceived Ease of Use minimally influences an individual's acceptance, yet significantly influences Perceived Usefulness, then the major emphasis of the TAM model looks to be Perceived Usefulness and the relationship between PEU and PU cannot be ignored (King and He, 2006). This finding is important to both researchers and managers in that if only one construct can be used, Perceived Usefulness would be the most important. It is important when implementing new technology to take into account an individual's perceived ease of use when trying to influence their perceived usefulness.

Another commonality among the summary papers was their look at additional constructs other than those included in the original TAM model. These researchers found that subjective norm, type of user (student vs. non-student), type of technology (*i.e.* business application vs. internet), and culture (western vs. non-western), may be important moderators to technology acceptance (King and He, 2006). The exclusion of these constructs may indicate a weakness of the TAM model.

Despite the TAM's success in explaining the broad beliefs associated with technological adoption, its weakness lies in its lack of specificity in identifying the actual usages that determine the significance of adoption. While the TAM shows that technology is adopted because it is useful, it says nothing about what those uses might be. An expanded version of the TAM, dubbed TAM2, was proposed to integrate and combine the social influence such as the Subjective Norm and Image constructs with the utilitarian (PU, PEOU) theories (Venkatesh and Davis, 2000). TAM2 addresses the antecedents of PU, but again only in terms of broad, pre-adoption and belief based constructs.

Based on the TAM, this study has identified perceptions as one of its main constructs that could affect learners' intention to adopt and use Internet services. Thus, the researcher hypothesised:

H4: Perceptions about Internet resources will moderate the effect of behavioural intention on use of Internet services to enhance learning.

3.3.9 Strengths and Limitations of the UTAUT model

The strength of the UTAUT model and the reason why researchers use it is its strong theoretical foundation, comprehensiveness, and the rigor that went into its development (Schaper & Pervan, 2004). Venkatesh *et al.*'s original research found the UTAUT model explained up to 70% of variance (adjusted R²) in usage intention where the other models accounted for between 17% and 53%.

Critics posit that the UTAUT model is a reincarnation of the Theory of Reasoned Action and Theory of Planned Behaviour models (Benbasat and Barki, 2007). Others state the UTAUT model, even with forty-one independent variables for predicting intentions and at least eight independent variables for predicting behaviour, omit important independent variables (Bagozzi, 2007). These researchers suggest a model that better conceptualizes system usage, looks at a broader user perspective,

integrates longitudinal studies, and identify the causes of the beliefs inherent to adoption.

This research intends to address these limitations, specifically the beliefs inherent to adoption, by looking at how the learners' context can be used to support a technology implementation. Of particular interest is social influence, the exclusion of which Legris, Ingham and Collette (2003) found to be a weakness of TAM. Their meta-analysis of TAM caused them to conclude that TAM is a useful model but has to be integrated into a broader one, which would include variables related to both human and social change processes and the adoption of the innovation model.

The inclusion of social influence as a determinant of technology acceptance is one way to address this weakness of TAM. However, as outlined in Figure 3 of this chapter and as will be described in Chapter 5, social influence, even in the UTAUT model, has proven to provide inconsistent results as a predictor of behavioural intention. This research has hypothesised social influence to play a positive role on Internet services adoption and use.

3.4 CONCLUSION

This chapter used the UTAUT (based on various theories) to address all the research questions in the following way:

The IDT formed the basis of the discussion concerning the role of performance expectancy on behavioural intention as research question one was posed. The same theory was used to answer research question four on the best predictor of Internet services. The alternative hypothesis regarding performance expectancy's influence on behavioural intention was also formulated based on the IDT, and further empirical testing is done in Chapter 5, section 5.3.1.

The TPB was the foundation on which effort expectancy was based. Research question two sought to determine if the ease of use would influence behavioural

intention. The alternative hypothesis regarding effort expectancy's influence on behavioural intention was also formulated based on the TPB, (see results in Chapter 5, section 5.3.2).

The IDT was also influential in the researcher's choice of experience as a confounding variable; however, this variable seems to be a result of persistent use and does not directly influence behavioural intention.

The TRA provided answers to research question five by determining which of the learners' demographics has an influence on behavioural intention.

The SCT also addressed research question five and Internet self-efficacy was identified as a confounding variable.

The TAM and TAM2 was used to address the third hypothesis on the role of social influence on behavioural intention. Social influence was found not to play a positive role in this study and the alternative hypothesis was rejected (*cf.* Chapter 5, section 5.3.3).

The UTAUT model may have overlooked other factors concerning the adoption and use of Internet services by secondary school learners in an impoverished context, as this study has done. This led to the design of the AATL which infused price of Internet, perceptions, and persistent use from three theories (MM, TAM, and MPCU) respectively. The design of the AATL was an effort to address research question six.

CHAPTER 4

RESEARCH METHODOLOGY

4.0 INTRODUCTION

This chapter defines the two extreme epistemological approaches to research and the need to look at both positivist and interpretive as valid approaches to Information Systems research. It also justifies the use of the research design and methodology by explaining how the research sample was chosen, the instrumentation used for data collection, and describing the analytic techniques employed in the study. The chapter also discusses the trustworthiness and rigor of the results and sets the tone for the analysis and interpretation of the results in the next chapter. The subsequent sections are organised into the following sections: i) Philosophical beliefs, ii) Research paradigms, iii) Research approach, iv) Research design, v) Data collection method, vi) Sampling and justification, vii) Validity of data, viii) Data analysis techniques, ix) Ethical measures. This Internet technology study examined the factors that determine the adoption and use of Internet services among secondary school learners in the Eastern Cape.

4.1 ONTOLOGY AND EPISTEMOLOGY

This section outlines the two important philosophical beliefs necessary to understanding a research project: ontology, and epistemology. First, ontology refers to “what we know”, what exists, and the form and nature of our reality (Punch, 1998). There are two extreme views of the world, realism and nominalism. Realists look at knowledge as objective and assume the empirical world is objective and independent of humans. Nominalists are more subjective and feel the empirical world exists through the action of humans (Orlikowski & Baroudi, 1991). These are two extreme positions and, in reality, research falls somewhere on the continuum of philosophies. In other words, the six research questions posed in this study are an

instrument through which the researcher acquired knowledge (ontology). This was done to select the best paradigm.

Table 1: *A Comparison of Positivism to Interpretivism (Source: McMillan and Schumacher, 1997:17)*

METATHEORETICAL ASSUMPTIONS ABOUT	POSITIVISM	INTERPRETIVISM
Ontology	Person (researcher) and reality are separate.	Person (researcher) and reality are inseparable (life-world).
Epistemology	Objective reality exists beyond the human mind.	Knowledge of the world is intentionally constituted through a person's lived experience.
Research Object	Research object has inherent qualities that exist independently of the researcher.	Research object is interpreted in light of meaning structure of person's (researcher's) lived experience.
Method	Statistics, content analysis.	Hermeneutics, phenomenology, <i>etc.</i>
Theory of Truth	Correspondence theory of truth: one-to-one mapping between research statements and reality.	Truth as intentional fulfilment: interpretations of research object match lived experience of object.
Validity	Certainty: data truly measures reality.	Defensible knowledge claims.
Reliability	Replicability: research results can be reproduced.	Interpretive awareness: Researchers recognise and address implications of their subjectivity.

From Table 1, ontology in the quantitative approach is usually based on what is called a logical positivist philosophy, which assumes there are social facts with a single objective reality separated from the feelings and beliefs of individuals. The quantitative research believes in an objective reality, which can be “explained,

controlled, and predicted by natural (cause-effect) laws” (McMillan and Schumacher, 1997:408).

Where ontology is concerned with the nature of reality, epistemology refers to how we know what we know, how we make value judgments, or how we know what is true. Epistemology is concerned with the question of what is truly knowledge and what is the relationship between what is known and who knows it (Punch, 1998). It is important to understand the epistemological viewpoint of any research model in order to understand the research outcomes and how the researcher came to the conclusions.

4.2 POSITIVIST VERSUS INTERPRETIVIST PARADIGM

From a research perspective, how people look at the world falls on a continuum between positivist and interpretive points of view (Braa & Vidgen, 1999). A positivist approach to research is logical, empirical and value-free (Susman & Evered, 1978). The researcher is an observer, acts as an outsider to the process, and tries not to intervene in the situation (Braa & Vidgen, 1999). A positivist creates new knowledge only when it can be verified through measurement and observation (Domholdt, 2005). Positivist research usually starts with a theory or predetermined relationship which is then investigated using structured instruments such as surveys or laboratory experiments (Orlikowski & Baroudi, 1991). To be valid, the results must be replicable and applied universally. Quantitative research stems from the positivist perspective where information is expressed as numbers and can be quantified (Punch, 1998). Quantitative research analyses data as empirical information in numerical form in order to gain an understanding of a situation that can be, by extension, applied to universal situations. Quantitative research seeks to prove causal relationships in order to predict future situations based on particular relationships or variables (Punch, 1998).

The interpretivist approach, on the other hand, assumes individuals create their own subjective reality as they interact in their environment (Orlikowski & Baroudi, 1991). Interpretive research attempts to understand the world from the inside, one situation at a time. The interpretive epistemology is that reality is very much a situational, social construct. New knowledge is generated when there is an understanding of the complex environment and information is gained about a particular situation at a specific time. The aim of interpretive research is not to gain a universal truth, but to better understand a unique, complex human process in a particular situation that can then be used to inform other situations (Baskerville & Wood-Harper, 1996,). Interpretive research is most often qualitative in nature looking at empirical information about our environment that is not in numerical form (Punch, 1998). This information is usually in the form of words such as interview transcripts, recordings, or observational records.

Positivist research has long been a dominant style in the social sciences, including Information Systems research (Susman & Evered, 1978). Orlikowski & Baroudi (1991) reviewed 155 Information Systems research articles written between 1983 and 1988. They found that 96.8% were from a positivist perspective, 3.2% were from an interpretive perspective, and 3.2% utilised mixed research methods. A number of IS researchers have expressed concern with the dominance of positivist research and the lack of interpretive and mixed method research (Evered & Louis, 1981; Coghlan, 2004).

The study of information systems is much more than the development of computer systems. Information Systems (IS) research is concerned with technology, psychology, economics and the integration of technology and organisations. The implementation of a new technology is a complex phenomenon in that it includes technology, people, society, and an environment that is constantly changing. It is comparable to other management and organisational research containing the same complex, real world challenges (Mingers, 2001). Practitioners are finding traditional IS research to be irrelevant and unreadable (Coghlan, 2004). Positivist research

does not address the needs or provide solutions that can be applied to practice (Galliers, 1993). Evered and Louis, as far back as 1981, wrote that IS research solely conducted from a positivist point of view produces “feeble results - results that are precise but irrelevant” (Evered & Louis, 1981: 393).

Positivism is thought to be deficient by interpretivists as a means of understanding social situations. The very idea of causation is a positivist perspective, where interpretivists feel the world is too complex and dynamic to look for a causal relationship (Punch, 1998). Susman and Evered (1978) in their seminal paper on Action Research, posited that positivism is deficient in generating knowledge for organisations who need to solve unique problems due to a number of reasons including the positivist treatment of people as objects of inquiry, that history is not taken into account, and that the methods are values neutral. The interpretive approach, as Lee (1991:347) states, “maintains that the methods of natural science are inadequate to the study of social reality. This school of thought takes the position that people, and the physical and social artefacts that they create, are fundamentally different from the physical reality examined by natural science.”

4.3 POST-POSITIVIST PARADIGM (HYBRID APPROACH)

The traditional view towards epistemology has been that research is conducted from a single approach, either positivist or interpretive. Mingers (2001: 240-241) wrote that traditionally, research “paradigms are based on mutual exclusivity and contradictory assumptions and individual researchers do, or should, follow a single paradigm”. Again, due to the fact that IS research takes place in an organizational context, a single epistemological approach has been questioned. Evered and Louis (1981: 393) wrote, “Our ability to grasp the breadth, depth, and richness of organisational life is hampered by allegiance to a single mode of inquiry”.

There is evidence that researchers are trying to address this issue by using a combination of interpretive and positive methodologies in order to better understand

and explain complex phenomenon (Braa & Vidgen, 1999; Trauth & Jessup, 2000). Mingers (2001) reviewed six journals between 1993 and 1998 for multiple methods and found that two thirds of the articles contained empirical research, 80% used surveys, interviews, experiments, or case studies and 13% of the empirical research used more than one research method.

Mingers (2001) outlined three types of multi-method research approaches. The first is loose pluralism which supports the use of a variety of research approaches but does not specify how or when to use positivism or interpretive. The second is complementarism which advocates the use of different approaches based on different assumptions about the context of use. A complementarism approach employs a positivist approach in one situation and an interpretivist in another situation based on the research question and methods used. Lastly, Mingers supports a strong pluralism approach to mixed method where all research is seen as complex and multi-dimensional and would benefit from a range of methods.

Strong pluralism advocates for the use of different approaches for different activities. Mingers (2001: 245) posits that, “research is a process with different types of activities which will predominate at different times. Particular research methods are more useful for some functions than others, so a combination of approaches may be necessary to provide a more comprehensive research outcome.” The advantages of multi-method research include the ability to gain a wider comprehension of the situation by approaching the situation from different perspectives, to validate findings by combining a variety of methods, and to stimulate innovation and creativity by introducing new ways of knowing.

The implementation of a multi-method research project is not without challenges, however. Mingers (2001) outlines three main challenges for the researcher when conducting a multi-method study. The first is philosophical in that the two approaches are so different ontologically and epistemologically that the researcher

must select one approach. The assumption is that philosophically, positivism and interpretivism are polar opposites, representing competing “truths” about the world and cannot be reconciled. Mingers writes that recent research has found flaws in this assumption. Mingers and others support the philosophy that different approaches provide different perspectives into reality that is more complex than traditional theories can reflect (Evered & Louis, 1981; Stone, 1990; Lee, 1991; Mingers, 2001).

The second challenge is cultural in that the IS community has traditionally held that positivism is the only valid scientific approach (Lee, 1991). The dominance of positivism is reflected in the criteria of IS journals, the focus of dissertation supervisors and the work of leading IS researchers (Mingers, 2001). Also, many researchers are not trained in multiple approaches and therefore work in the area that they are most comfortable. In order to address this challenge, changes need to occur in academic curriculums, publication criteria, and researcher qualifications (Mingers, 2001).

The third challenge is psychological and the ability of a researcher to move from one approach to another. The migration between multiple approaches requires intentional consideration to each approaches characteristics, which will be discussed in more depth in the following paragraphs. In addition, researchers, like any individual, have preferred personality styles and comfort areas. The researcher must overcome research preferences and work in new areas, which may require training and collaboration across disciplines (Mingers, 2001). Lastly, there exist a number of practical barriers to multi-method research. Researchers are continually under pressure to publish, especially young researchers seeking occupation. It is easier to publish in the traditionally accepted, positivist culture (Mingers, 2001).

Overall, these challenges are surmountable and are necessary to address the complex environment of Information Systems research. Evered and Louis (1981: 386) posited the need for multi-methods by writing, “greater epistemological appreciation seems to be an essential prerequisite to developing an appropriate

inquiry approach whereby researchers would explicitly select a mode of inquiry to fit the nature of the problematic phenomenon under study, the state of knowledge, and their own skills, style and purpose.”

In order to understand which approach to adopt in each situation, the researcher must understand the implications of each research perspective and act in ways that reflect that knowledge (Lee, 1991). Evered and Louis provide a means of understanding the implications of the two research perspectives through the terms “inquiry from the outside”, referring to the analytical/positivist approach and “inquiry from the inside”, representing the interpretive approach to ways of knowing. (Evered & Louis, 1981). Inquiry from the inside should be used to explore a particular situation or organisation in order to gain an understanding of that organization, similar to the interpretive approach. The resulting knowledge would be used in that context to better understand that organisation’s needs. Inquiry from outside, similar to positivist research, is appropriate when testing a theory or looking to gain a universal truth. There is no right or wrong approach, the choice of approach should depend on the research question, the situation, and the researchers’ expertise (Evered & Louis, 1981).

Stone (1990) adapted concepts from Evered and Louis (1981) to create a summary of analytical, or positivist, and interpretive modes of inquiry in relation to the research characteristics. Table 2 outlines the extremes of the approaches and assumptions associated with the analytical dimensions (Stone, 1990).

Table 2: *Characteristics of Positivist and Interpretive Paradigm (Source: Stone, 1990)*

Characteristic	Positivist (Analytical)	Interpretive
Researcher's role.	Onlooker	Participant
Researcher's Relationship to Setting.	Detached, Neutral	Immersed, Involved
Validation Basis.	Measurement and Logic	Experiential
Sources of Categories.	Predefined	Emergent
Aim of Inquiry.	Universality and generalizability	Situational relevance
Knowledge Acquired.	Universal, Nomothetic: Theoretical.	Particular, Idiographic: Praxis
Nature and Meaning of Data.	Factual, Context Free	Interpreted, Contextually Embedded
Evaluation Language.	Quantitative (High precision, low variety)	Qualitative (Low precisions, high variety)

The first assumption has to do with the researcher's role as an onlooker or inquirer from the outside versus as a participant in the organisation or inquirer from the inside. The relationship of the researcher to the organization is assumed to range from the detached, neutral, unbiased observer who has no influence over the results of the study to the immersed, involved, active participant who becomes a part of the phenomena of the research. The researcher then validates the findings through measurement and logic versus subjective interpretation and experience.

Different assumptions also exist as to how research data is organised and classified. The positivist approach is to predefine or pre-organise the data, which serves as justification for hypotheses and guides the data collection process. On the other hand, the interpretive study would not have predefined categories. Interpretive

evaluations would begin with observations and categories would emerge as the data is reviewed and interpreted.

Another difference is the aim of the research. As outlined above, the aim of a positivist study is to generalise the results for universal applicability, whereas the interpretivist's goal is to understand a particular situation and how that understanding could be applied or relevant to other environments. It follows then, that the type of knowledge acquired also differs. The positivist generates universal or theoretical knowledge, whereas the interpretive research would result in praxis knowledge, the knowledge of how to act in particular situations. Theoretical knowledge attempts to be universally true and has the ability to predict and explain events. Praxis knowledge does not exist independently from understanding the subjective environment within which it was received. Praxis knowledge provides detailed, relevant information for a particular context but is of questionable applicability to other settings, whereas theoretical knowledge provides generalizable information that is of questionable value in understanding unique contexts and settings.

This leads to assumptions as to the nature and meaning of the research data. The positivist creates data that is free of setting and context and completely factual, whereas the interpretive information is contextually embedded in the complex environment from which it was gathered and cannot be separated. These assumptions, then, lead to the type of language used by the researcher when evaluating and presenting the findings. Positivists utilise quantitative language that is characterised by high precision and low variety. The qualitative language of the interpretivist focuses on the perspectives of the members of the organisation with low precision and high variety. The term "variety" reflects the ability of the researcher to express the complex range of characteristics of the study that is available to the qualitative research. Precision, on the other hand, reflects the ability of positivists to provide exact measurements of the item being studied (Stone, 1990).

Both approaches have something to offer a researcher and do not necessarily have to be mutually exclusive (Trauth & Jessup, 2000). As Evered and Louis (1981: 392) write, “One is methodologically precise, but often irrelevant to the reality of organisations; the other is crucially relevant but often too vague to be communicated to or believed by others”. By understanding the implications of each approach, it is possible to deploy the approach most appropriate for the researcher, the research question, and the research method.

Lee (1991: 364) goes on to say that “the organisational researcher may, with justification and without contradiction, utilise a range of methods that are objective and subjective, nomothetic and idiographic, quantitative and qualitative, outsider and insider, and etic and emic.”

The section also described and justified the use of multi-methods to provide a comprehensive understanding of the organisation and context being studied. Ryan (2006) argues that the only way to avert these complexities and to tap from historical contingencies without compromising validity and reliability of the instruments (to be used for collecting data) will be to use various methods of data collection and analysis. Scholars like Maree (2007) and Mackenzie and Knipe (2006) have gone to the extreme by saying post-positivism is the uttermost portrayal of realism. They state that post-positivism is holistic and an embodiment of totality.

However this paradigm contrary to Maree (2007), Mackenzie and Knipe (2006) has been criticised for failure to come up with something new (Healy & Perry, 2000). While it covers the gaps that the positivist and interpretivist paradigm leave, it merely repeats what both positivists and interpretivists have already said. Positivists like Kraus (2005) and Ryan (2006) still condemn the post-positivist paradigm for subscribing to interpretivist methods, which they claim collects immeasurable data.

4.3.1 Positivist Research Techniques

4.3.1.1 Experimentation

This is a way of testing hypotheses using a variable to assess causal relationships by allocating subjects randomly into two groups. One group is used as control while the other is subjected to tests (Oakley, 2000).

4.3.1.2 Surveys

Adams (2007) defines a survey as a method of gathering data by asking respondents questions in any of the following ways: a) Telephone, (b) Questionnaires, c) Post, d) Internet.

4.3.2 Different types of surveys

a) *Cross-Sectional Surveys*: Data are collected at one point in time from a sample selected to represent a larger population. The current study employed this type of survey.

(b) *Longitudinal Surveys* = Trend, Cohort, and Panel

(c) *Trend*: Surveys of sample population at different points in time

(d) *Cohort*: Study of same population each time data are collected, although samples studied may be different.

(e) *Panel*: Collection of data at various time points with the same sample of respondents (Adams, 2007).

4.4 THE PARADIGM THAT GUIDED THIS STUDY

Based on the research questions, this study was anchored on the positivist paradigm. It was the most practical and purely scientific paradigm, which could bring out the answers to the questions of this research without any ambiguity and controversy.

This study investigated the factors that determine learners' intention to adopt and use Internet services in one secondary school. A quantitative approach based on the positivist paradigm was used for the measurement of data. Data that answered the following research questions were collected:

- What is the effect of performance expectancy on the learners' intention to adopt and use Internet services?
- What degree of variation exists for effort expectancy on learners' intention to adopt and use Internet services?
- How much of the determinants explain the usage of Internet services?
- Which is (are) the best predictor(s) of Internet services' usage given a set of determinants?
- What is the effect of confounding variables (if any) on Internet services' adoption and usage?
- Which model can be designed based on the best predictor(s) of Internet services' adoption and usage for secondary school learners?

Figure 5 is a diagram illustrating a generic research process 'onion' showing the relationship between the various aspects of the research process. The research philosophy was firstly identified, followed by the research approach, research strategy selected, the time lines and the data collection methods.

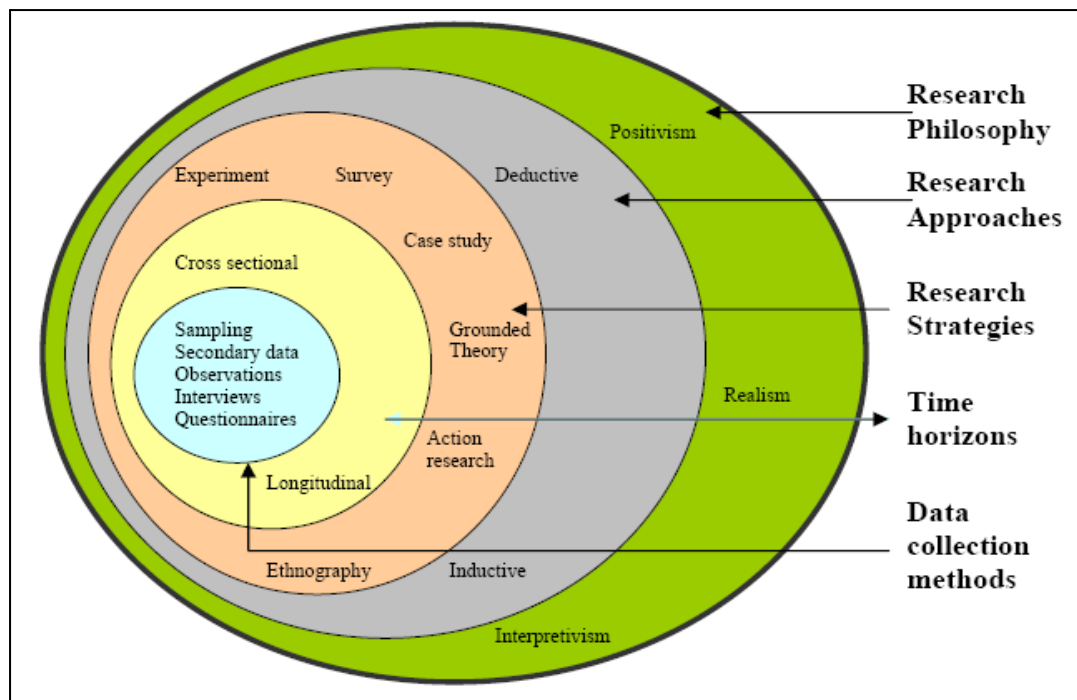


Figure 5: The research onion (Saunders, et al., 2009).

As illustrated in Figure 5, after the research paradigm was chosen, a quantitative deductive approach was applied to collect data through a survey. This research was a cross-sectional study that used structured questionnaires.

Researchers can therefore not prove a theory but can make it stronger by eliminating alternative explanations. The researcher in this study used a quantitative method that sought to validate the constructs that form the basis of UTAUT model. The next section explores the research approach used in this study.

4.5 QUANTITATIVE APPROACH

Monyatsi (2002:160) notes that one of the main “distinguishing characteristics between the quantitative and the qualitative approach to research is the relationship between cause and effect”. In the quantitative approach, statistical data analysis can be used to show such relationships, but the information rich qualitative research

approach provides explanatory data from the interview and observation schedules. McMillan and Schumacher (2001:32) also point out that apart from being the most commonly used method in educational research, a descriptive survey is quantitative and is often preferred because it is objective in data collection, quantifies variables and describes phenomena using numbers to characterise them. Saunders, Lewis and Thornhill (2007:358) assert that concepts, variables, and hypotheses are chosen before the study begins and remain fixed throughout the study in a static design.

The major difference between qualitative and quantitative research is not 'quality' but procedure (Ghauri, Gronhaug & Kristianslund, 1995). Illustrated in Table 3 are the differences between qualitative and quantitative research methods.

Table 3: *Comparison of the Quantitative and Qualitative Research Methods (Source: Ghauri et al., 1995)*

Qualitative Methods	Quantitative Methods
Emphasis on understanding.	Emphasis on testing and verification.
Focus on understanding from respondent's/informant's point of view.	Focus on facts and/or reason of social events.
Interpretation and rational approach.	Logical and critical approach.
Observations and measurement in natural settings.	Control measurement.
Subjective 'insider view' and closeness to data.	Objective 'outsider view' distant from data.
Explorative orientation.	Hypothetical-deductive; focus on hypothesis Testing.
Process oriented.	Result oriented.
Holistic perspective.	Particularistic and analytical.
Generalisation by comparison of properties and context of individual	Generalisation by population membership.

organism.

In the same way as illustrated in Table 3, this study has used quantitative techniques to determine the effect that certain independent variables (performance expectancy, effort expectancy, confounding variables, and social influence) have on the adoption and use of Internet resources. These independent variables also formed the hypotheses of the study as required in any quantitative approach.

McMillan and Schumacher (2001:9-10) explain that quantitative methodology uses a deductive form of logic where theories and hypotheses are tested for cause and effect. They further note that the approach uses predetermined hypotheses in order to develop generalisations that contribute to the theory and enable one to predict, explain and understand some situations. The quantitative approach “generates numbers which are analysed statistically, making comparisons and correlations possible” (Descombe, 2000:174).

Three types of research purpose *i.e.* descriptive, exploratory and explanatory research methods were considered in writing this research. Saunders, Lewis and Thornhill (2009) explain that, in conducting a descriptive research, it is necessary to have a clear picture of the phenomena on which you wish to collect data prior to the collection of the data. Exploratory research method, on the other hand, is particularly useful if one wishes to clarify his/her understanding of a problem, such as if one is unsure of the precise nature of the problem. Finally, explanatory research places emphasis on studying a situation or a problem in order to explain the relationships between variables (Saunders *et al.*, 2009).

This measured how much of the determinants explain the adoption and application of Internet services by high school learners. The adoption and use of Internet services are dependent variables and the determinants of Internet services are independent variables. However, moderator variables such as gender, age,

academic level, and the learners' background were analysed as socio-demographic data. For this quantitative research, the study employed two samples, the pilot sample for the development of instruments, and the main sample for substantive inquiry. After consideration of the research topic and focus, the purpose of this research is both descriptive and explanatory.

4.6 RESEARCH DESIGN

4.6.1 Survey Research

The study used a non-experimental survey as a method of collecting, processing and analysing data. The nature of predictor variables (performance expectancy, effort expectancy, social influence, and facilitating conditions) used does not allow manipulation; hence, the variables in the study were investigated in contemplation of past actions (Panneerselvam, 2008). Results using this method are interpreted with caution; they do not prove but only suggest cause and effect (Saunders *et al.*, 2007:135). Survey research "involves acquiring information about one or more groups of people, perhaps about their characteristics, opinions, attitudes, or previous experiences, by asking them questions and tabulating their answers". The ultimate goal is to learn about a large population by surveying a sample of that population (Leedy & Ormrod, 2005:183). The researcher posed a series of questions to willing respondents; summarised their responses with percentages, frequency counts, and more sophisticated statistical indexes; and then drew inferences about a particular population from the responses of the sample. All the questions asked had something to do with the research questions, which sought to investigate the determinants of Internet services' adoption and use among secondary school learners.

Survey research was intended for Grade 10, 11, and 12 learners where the researcher conveniently chose high school learners in the East London district. The researcher considered accessibility and the time frame when choosing the school, but ended up collecting questionnaires from Grade 11 learners.

4.6.2 A Justification of the choice of a survey

The research adopted the survey design as a way of conducting the research. The survey design is broad as it consists of asking people questions through the telephone, the internet, the questionnaire, and in many other emerging methods (Adams, Khan, Raeside and White, (2007).

Despite the criticism that surveys lack imagination (Goldenberg, 1992) the following are the qualities of the survey design that influenced the researcher to use it apart from the dictates of the question:

4.6.2.1 Uniqueness

It gathers information not available from other sources. Thus, the survey design enables the researcher to acquire original data to produce original information. The researcher was able to get first-hand information from the respondents as planned. Using a survey enables researchers to find something new in the society (Payne and Payne, 2007).

4.6.2.2 Non-probability and probability sampling

It has unbiased representation of population of interest as most subjects are given equal chances to participate (Trochim, 2006). It is also flexible in that a researcher can still use the non-probability sampling if the sample is big. In the current study, the researcher used convenience sampling to select the school, and the respondents were selected through stratified random sampling.

4.6.2.3 Standardization of measurement

Surveys gather the same information collected from all respondents making it easy for the researcher to deduce information. Surveys collect data from different points but all respondents respond to the same question using the same instrument making it easy for the researcher to be guaranteed of getting standard information. The researcher administered the same structured questionnaire to all the respondents in his research.

4.6.2.4 Analysis needs

Surveys use data to complement existing data from secondary sources. Theories can be tested or verified using surveys. By virtue of being able to assess human behaviour in a large sample or population, what writers have said or hypothesised can be verified or tested within a short space of time. The researcher was able to test what other researchers found by using the conceptual framework and theoretical framework from journal articles, books and the Internet to verify with the empirical findings.

4.6.2.5 Convenient sample size

This type of design that allows the researcher to use his/her discretion can enable the researcher to deal with big sample sizes within a short time (Creswell, 2003). Hence, the study was able to gather data from 116 learners, from high school learners in the East London school district within three weeks. Leedy and Ormrod (2005) also agree that surveys can be sent to a large number of people, including those who live thousands of miles away. Thus they may save the researcher travel expenses, and postage is typically cheaper than a lengthy long-distance telephone call. From the perspective of survey respondents, this distance becomes an additional advantage.

4.6.2.6 Anonymity of respondents

The respondents can respond to questions with assurance that their responses will be anonymous, and so they may be more truthful than they would be in a personal interview. Particularly when they are talking about sensitive or controversial issues (Leedy & Ormrod, 2005). The researcher adhered to this ethical measure by ensuring that the respondents' names and personal information were not disclosed.

4.7 DATA COLLECTION METHOD AND ANALYSIS

When writing a proposal, it is important to make a general decision about the research method to be used (Fisher, 2007). In other words, all available method should be considered and some form of elimination process used to find a suitable method or methods that will be used (*ibid*). According to Saunders *et al.* (2007), there are two approaches to collecting data for a project and these are: primary data and the secondary data. They further explained that, primary data are collected when a particular purpose arises whereas secondary data are already collected data, which has been published, and for which new researchers can rely on as a source of information.

4.7.1 Primary Data

Primary data are first-hand information data collected specifically for the research project being undertaken (Saunders *et al.*, 2009). This could be in the form of an interview records, written and kept by people involved or who bear witness to an event (Burns, 2000). Primary data can be collected through observation, interviews, or the use of questionnaires (Saunders *et al.*, 2009). For this study, primary data were gathered through a questionnaire (*cf.* Appendix E) that was administered on the actual learners in a secondary school.

4.7.1.1 Questionnaire

Orodho (2004:39) notes that “in education and social sciences research, the most commonly used instruments are questionnaires, interview schedules and observation forms”. Thus, questionnaires were used to collect important information about the population. Questionnaires were preferred for this study because they generate quantifiable data ready for statistical analysis (Mugenda, 2008). Questionnaires allowed each one of the respondents to read and answer identical questions, thereby ensuring consistency of the demands. Saunders *et al.*, (2007) add that questionnaires also generate standardised data, which makes the processing of responses easier. “Standardised data helped to increase the validity and reliability of the results” (Panneerselvam, 2008:93).

Completed questionnaires were collected during visits at the school as each learner filled in the questionnaire at home. Respondents were also allowed to ask questions to clarify research items and were requested to answer every item in the questionnaire as truthful as possible.

4.7.1.2 Drawbacks of questionnaires

Normally, the majority of people who receive questionnaires do not return them. In other words, there may be a low return rate and the people who do return them are not necessarily representative of the originally selected sample. Even when people are willing participants in a questionnaire study, their responses will reflect their reading and writing skills and, perhaps, their misinterpretation of one or more questions. Furthermore, by specifying in advance all the questions that will be asked and thereby eliminating other questions that could be asked about the issue or phenomenon in question, the researcher is apt to gain only limited, and possibly distorted, information (Leedy and Ormrod, 2005). In this study, the researcher distributed 286 questionnaires but the respondents returned 116 usable

questionnaires. Some respondents did not reply to certain statements and their non-response was indicated as such when entering data on the SPSS.

4.7.2 Structure of the questionnaire

The five sections (section A to E in Appendix E) of the questionnaire used closed questions to enable the learners of all cognitive levels to participate. These items were designed in such a way that all learners can interpret them as individuals without assistance by anyone. All questions required the learners to select choices in different degrees of agreement and disagreement on a Likert scale.

The researcher took advantage of the clarity and reliability of closed questions to increase the learners' response rate and reduce variability in responses (*cf.* Chapter 5, Table 8, 9, 12, and 14). Open questions were avoided simply because they tend to be more academically demanding than closed questions. Most learners cannot interpret questions accurately and only closed questions can help them to understand the questionnaire.

The scale for indecision was deliberately omitted to allow respondents to commit themselves. Usually the indecision scale is used by respondents who either do not want to commit themselves or never understood the question as an escape route (Adams *et al.*, 2007). The researcher based on established procedures in literature developed the survey instrument used for this research. The questionnaire was developed in order to collect the necessary data on the moderator variables, the access to ICT facilities, ICT knowledge, ICT application, challenges facing ICT literacy development among high school learners in East London.

4.7.2.1 SECTION A: Demographic information

Section A (*cf.* Appendix E) comprised six dichotomous questions and is focused on demographic information of learners: gender, age, grade, residential area, the kind of Internet devices they have, and major subjects taken at school.

4.7.2.2 SECTION B: Internet Self-efficacy

Section B (*cf.* Appendix E) was designed to know the ability of learners in using the Internet. The section contained 15 items which required the respondents to either select a 'yes' or a 'no'.

4.7.2.3 SECTION C: Use of Internet for Learning

Section C (*cf.* Appendix E) focused on the learners' use of Internet for learning purposes. In this section, they had to tick all the activities they have done before.

4.7.2.4 SECTION D: Six independent variables

Section D (*cf.* Appendix E), which contained 30 items focused on performance expectancy, effort expectancy, perceptions, price of Internet, persistent use, and behavioural intention. A Likert scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) was used.

4.7.2.5 SECTION E: Internet usage frequency

Section E (*cf.* Appendix E) of the questionnaire contained three items, which addressed the usage frequency of SMS, MMS, and ringtone and logo download by learners. The response modes were: 'Never' (N); 'Rarely' (R); 'Often' (O); and 'More often' (MO).

4.8 ADMINISTRATION OF THE QUESTIONNAIRE

The researcher used group administration of the questionnaire with learners. This was aimed at enhancing a higher response rate (Maree, 2007). In this way of administration, the researcher had a chance to explain unclear items, which normally delay the administration of questionnaires.

However, explaining unclear items to respondents can also reduce the validity of data as the researcher interferes with individual responses. To enhance validity this was done cautiously.

4.8.1 Editing

This refers to the verification of questionnaire data accuracy, errors, completeness and omissions (Sindhu, 2003). The questionnaires were analysed one by one for errors, accuracy, completeness and omissions. They were grouped according to the same categories for easy coding. In this process, wrongly completed questionnaires were identified and if anything had to be done, respondents were to be contacted. However because of the condition of anonymity attached to the questionnaire this follow up could not be done. The few that were incomplete were coded for what was submitted.

4.8.2 Coding

Coding is the assignment of numeric or symbolic codes to different responses for easy identification during the classification process (Adams *et al.*, 2007). These codes were the only ones in which the data could be recognised by the quantitative research software called Statistical Package for Social Sciences (SPSS) version 21. These codes were allocated to gender, age, grade, or school grade, and for each response category. For example under gender, male was coded as 1 while female

coded as 2. The five age groups on the questionnaire (14, 15, 16, 17, and 18 upwards) were coded as 1, 2, 3, 4, and 5 (*cf.* Appendix E). The four response scales were coded simply as 1, 2, 3, and 4; Strongly Agree (1), Agree (2), Disagree (3) and Strongly Disagree (4). For usage Frequency, the four response scale was coded as 1, 2, 3, and 4; Never (1), Rarely (2), Often (3), and More often (4)

4.8.3 Classification

Classification is the categorisation or grouping of responses or data according to responses or types (Kothari, 2004). For example, data on each of the nine sections of the questionnaire was automatically extracted by SPSS informed by the research questions and sub-questions of the whole study. This stage prepares one for presentation of information gathered from the data.

These stages were done accurately and cautiously to avoid compromising data validity and reliability. This is a critical stage where the purpose and importance of a survey as a research design is tested to avoid abuse. It is during this process that unscrupulous researchers manipulate results of surveys to suit their ideological arguments (Kothari, 2004).

4.8.4 Secondary Data

Secondary data is data from existing information such as published books, articles, internet search engines etc. One of the benefits of collecting secondary data is that it saves time and cost for the researcher since the researcher uses existing information. Another major advantage of this process is that it serves as guide and aid on how to conduct the research (Saunders & Thornhill, 2003).

According to Ghauri *et al.*, (1995), one of the main disadvantages of using secondary data is that these data are collected for another study with different objectives and

may not completely fit the current problem. To support this study, articles published by other researchers in the area of Internet services were used extensively.

4.8.4.1 Literature Search

Literature, relevant to the purpose of this study, was found from different sources, such as, articles in academic journals and search engines. In addition, to the Internet, search tools like Google Scholar and search engine for online publications, were used (Leedy & Ormrod, 2005). In the search for relevant literature, key words like 'Cloud computing', 'UTAUT', *etc.* were used.

4.9 SAMPLING AND JUSTIFICATION

In the previous part of the discussion, a research strategy was selected for the study. The next step describes how the survey was carried out. Using this strategy, an appropriate study sample was selected to answer the research questions.

4.9.1 Probability Sampling

Saunders *et al.* (2009) note that probability sampling (or representative sampling) is most commonly associated with survey-based research strategies where you need to make inferences from your population sample, to answer your research question(s) or to meet your objectives. They further state that the process of probability sampling can be divided into four stages:

- (a) Identify a suitable sampling frame based on your research question(s) or objectives.
- (b) Decide on a suitable sample size.
- (c) Select the most appropriate sampling technique and select the sample.
- (d) Check that the sample is representative of the population.

4.9.2 Non-probability Sampling

Non-probability sampling (or non-random sampling) provides a range of alternative techniques to select samples based on subjective judgment and is also very useful when the resources available for conducting the research are limited (Saunders & Thornhill, 2009). The sample selection used for this study is a non-probability sampling and with a mix of convenience sampling. Saunders and Thornhill (2003) note that self-selection sampling occurs when the researcher allows each case, usually individuals, to identify their desire to take part in the research. The researcher therefore publicises his or her need for cases, either by advertising through appropriate media or by asking them to take part, and collect data from those who respond (*ibid*).

Saunders and Thornhill (2003) further stated that publicity for convenience samples could take many forms. These include articles and advertisements in magazines that the population is likely to read, postings on appropriate Internet newsgroups and discussion groups, hyperlinks from other websites as well as letters or emails of invitation to colleagues and friends (*ibid*).

Sampling refers to the selection of research respondents from an entire population and involves decisions about which people, settings, events, behaviours, and/or social processes to observe (Terre Blanche, 2006:49). The unit of analysis has a bearing on who is selected for the sample. This should be representative of the population, from which the researcher aims to draw conclusions. The size should be large enough to allow a researcher to make inferences about the population (McMillan & Schumacher, 2001).

In this study, the researcher sampled the research site and thereafter the respondents as follows:

4.9.3 Sampling the Research Site

The chosen sampling strategy for the research site was convenience sampling. This type of sampling was based entirely on that, the research site was “easily accessible and composed of elements, which contained the most characteristics, representative of a bigger population” (White, 2003:65). The school was not chosen through identification from prior information to enhance data quality. The school was only selected on the basis that it was a secondary school. The school was previously classified as a black disadvantaged township school. Cultural and racial diversity among the learners and teachers in the school were reportedly the same. It was composed of African teachers and learners and there were no cultural differences and racial diversity.

4.9.4 Sampling the Respondents

The school has Grades 8, 9, 10, 11, and 12 and the study targeted a population (N) of about 1020 learners. The school population consisted of boys and girls ranging between 13 and 20 years. The researcher determined the sample size by relying on published tables, which provide the sample size for a given set of criteria (Israel, 1992).

Table 4: *Shortened version of determining sample size using tables (Source: Israel, 1992:6)*

Size of Population	Sample Size (n) for Precision (e) of:			
	±3%	±5%	±7%	±10%
500	a	222	145	83
Continued	<i>Continued</i>	<i>Continued</i>	<i>Continued</i>	<i>Continued</i>
900	a	277	166	90
1,000	a	286	169	91
2,000	714	333	185	95
Continued	<i>Continued</i>	<i>Continued</i>	<i>Continued</i>	<i>Continued</i>
100,000	1,099	398	204	100

>100,000	1,111	400	204	100
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Sample size for $\pm 3\%$, $\pm 5\%$, $\pm 7\%$ and $\pm 10\%$, and precision levels where Confidence Level is 95% and $P = 0.05$.

From Table 4, the number of population was a determining factor of the choice of sample size as illustrated. Hence, 286 respondents were selected, assuming the confidence level of 95% and precision level of 5%. After the sample size had been determined, the respondents were selected using stratified random sampling.

4.10 DATA ANALYSIS TECHNIQUES

The analysis of the research questions was conducted using SPSS Version 21. The SPSS was used for the following analyses: For nominal data, the correlation coefficient (r) was used, to measure the relationship between dependent and independent variables, and also the p values significant at $p < 0.05$ level (*cf.* Table 4). The word nominal “implies name, which describes what the scale accomplishes - a naming of categories of people, events, or the phenomena” (McMillan & Schumacher, 1997:204). For ordinal data, the researcher employed descriptive statistics (measures of central tendency and variability), through the use of Mean (M), Standard Deviation (SD), one way analysis of variance (ANOVA), and Skewness (S). A one-way ANOVA is a statistical method to compare more than two groups; based on one independent variable (Statistics Solutions, 2013) Skewness illustrates the amount and direction of the slope (Brown, 2012).

In this study, the researcher got a general impression of skewness for all the independent variables (including the confounding variables) and analysed some common numerical measures of skewness as follows.

Brown (2012) suggests this rule of thumb:

If skewness is less than -1 or greater than $+1$, the distribution is highly skewed.

If skewness is between -1 and -0.5 or between $+0.5$ and $+1$ the distribution is, moderately skewed.

If skewness is between -0.5 and $+0.5$, the distribution is approximately symmetric.

Ordinal scale measurement assumes that values of the variable can be rank-ordered from highest to lowest (McMillan and Schumacher, 1997).

Based on theory, the independent variables (performance expectancy, effort expectancy, social influence and confounding variables) used in this research formed part of the experiment that the researcher manipulated. On the other hand, the dependent variable was the effect of the independent variables (Thomas & Nelson, 1996).

4.10.1 Measures of central tendency

Measures of central tendency mean a central point around which the data regarding a particular variable is equally distributed. Statistically, the researchers “commonly employ the mode, the median, and the mean to find such a point (Leedy and Ormrod, 2005:257)”. The mode is the single number or score that occurs most frequently.

For instance, in this study the researcher used frequency tables to establish which scores occur most frequently and later turned that information into correlations. Leedy and Ormrod (2005) state, that the median on the other hand is the numerical centre of a set of data, with exactly as many scores above it as below it. The mean is the measure of central tendency that researchers and statisticians most commonly use.

4.10.2 Measures of variability

The standard deviation is the standard measure of variability in most statistical procedures. Whereas many statistical procedures use another measure of variability

known as the variance, which is simply the standard deviation squared (Leedy and Ormrod, 2005). This study used ANOVA to measure the effect of confounding variables on learners' intention to adopt and use Internet services.

Confounding variables (third variables) are variables that the researcher fails to control, or eliminate, damaging the internal validity of an investigation (Shuttleworth, 2008). A confounding variable, also known as a third variable or a mediator variable, can adversely affect the relation between the independent variable and dependent variable. This may cause the researcher to analyse the results incorrectly. The results may show a false correlation between the dependent and independent variables, leading to an incorrect rejection of the null hypothesis. However, if there is some other variable that changes along with the independent variable, then this confounding variable could be the cause of any difference (Shuttleworth, 2008). To avoid this blunder, three variables namely; Internet self-efficacy, Internet experience and demographic factors were conceptualised as confounding variables.

4.10.3 Measures of relationship

The statistical process by which researchers discover the nature of relationship among different variables is called correlation. The subsequent statistic, called a correlation coefficient, is a number between -1 and +1; and most correlations are decimals (either positive or negative) somewhere between these extremes (Leedy and Ormrod, 2005).

This study employed Pearson correlation statistics (*cf.* Chapter 5, Table 7) to determine the relationship that exists between performance expectancy, effort expectancy and the learners' intention to adopt and use Internet services.

A one way ANOVA was also conducted to determine the level of influence that the confounding variables, effort expectancy and performance expectancy have on the

learner's intention to adopt and use Internet services (*cf.* Chapter 5, Table 11). Pearson correlation in conjunction with ANOVA was also helpful in determining the best predictors of the use of Internet services. Leedy and Ormrod (2005) argue that correlation coefficient for two variables concurrently tells us two different things about the relationship between those variables (direction and strength).

4.10.3.1 Direction of the correlation coefficient

In this study, the sign of the correlation coefficient indicate the direction of the relationship. A positive (+) number indicates a positive correlation. As one variable increases, the other independent variables also increase (Leedy & Ormrod, 2005). In contrast, a negative (-) number indicates an inverse relationship or negative correlation. As one variable increases, the other variable decreases.

4.10.3.2 Strength of the correlation coefficient

On the other hand, Leedy and Ormrod (2005) assert that, the strength of the relationship among variables is indicated by the size of the correlation coefficient. A correlation of +1 or -1 indicates a perfect correlation. The correlation coefficient between two continuous-level variables is also called Pearson's r or Pearson product-moment correlation coefficient. A positive r value expresses a positive relationship between the two variables (the larger A, the larger B) while a negative r value indicates a negative relationship (the larger A, the smaller B). A correlation coefficient of zero indicates no relationship between the variables at all. However the correlations are limited to linear relationships between variables. Even if the correlation coefficient is zero, a non-linear relationship might exist (*cf.* Table 7). The strength and the direction of the correlations (for performance expectancy, effort expectancy, and confounding variables) were crucial in determining whether a relationship existed between the independent variables and

the learners' behavioural intention. Correlations were mainly used to address research question one, two and three.

4.10.4 Assumptions underpinning the inferential analysis

Linear regression makes several key assumptions and in the next chapter, the study tested whether the following four assumptions were met:

4.10.4.1 The assumption of linearity

Firstly, linear regression needs the relationship between the independent and dependent variables to be linear. Linear regression needs at least two variables of metric (ratio or interval) scale. It is also important to check for outliers (extreme deviation from the mean) since linear regression is sensitive to outlier effects. The linearity assumption can best be tested with scatter plots. The following two examples depict two cases, where no and little linearity is present. The linearity assumption can also be tested by using Pearson correlation statistics, to determine the presence or lack of statistical significance of the correlation coefficient (Statistics Solutions, 2013). This study confirmed linearity between independent variables and dependent variables by using the lack of fit test. Linearity results for this research can be found in Chapter 5, from section 5.2.1.1.

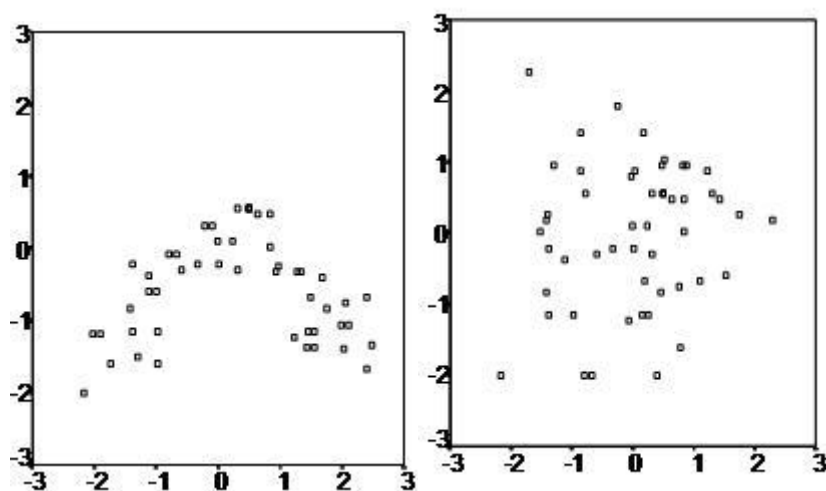


Figure 5.1: Scatter Plots (Statistics Solutions, 2013)

The null hypothesis for this test is: A linear model is not appropriate.

The alternative hypothesis is: A linear model is appropriate.

Failure to reject the alternative hypothesis satisfies this assumption.

4.10.4.2 Independence of cases

Secondly, when testing the independence of cases, the Durbin-Watson statistic was used. As a general rule of thumb, the residuals are not correlated if the Durbin-Watson statistic is approximately 2, and an acceptable range is 1.50 - 2.50.

This assumption concerns another type of systematic error in the residuals that is produced by estimated values of the dependent variable that are correlated from one case to the next, *i.e.* serially correlated. This violation occurs most frequently when the independent variable is time, though it can occur if the cases are sorted on one of the predictors (Statistics Solutions, 2013).

Since the time factor did not happen in this study, it was easy to check for it because the SPSS computed the Durbin-Watson statistic that the researcher needed for the test. The value of the Durbin-Watson statistic ranges from 0 to 4. As a general rule of thumb, the residuals are not correlated if the Durbin-Watson statistic is approximately 2, and an acceptable range is 1.50 - 2.50.

The results for the independence of cases for this research can be found in Chapter 5, from section 5.2.1.1.

4.10.4.3 Normal distribution of the population

The linear regression analysis requires all variables to be multivariate normal. (Brown, 2012) suggest four ways in which this assumption of normality can be tested. Normality can best be checked with a histogram and a fitted normal curve or a Q-Q Plot as illustrated in Figure 5.1.1 and 5.1.2. Normality can also be evaluated

using, the skewness or kurtosis statistics to check if they are within the range of acceptable values from -1.0 to +1.0. Lastly, normality can also be checked with a goodness of fit test, e.g., the Shapiro-Wilk test. When the data is not normally distributed a non-linear transformation, e.g., log-transformation might fix this issue, however it can introduce effects of multicollinearity (Statistics Solutions, 2013). In evaluating normality, this study used the skewness to check if values obtained were both within the range of acceptable values from -1.0 to +1.0.

The results for normality of distribution for this research can be found in Chapter 5, from section 5.2.1.1.

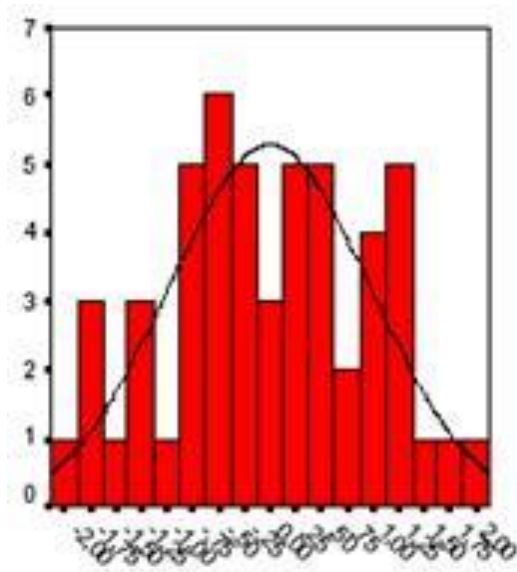


Figure 5.1.1: Histogram (Brown, 2012)

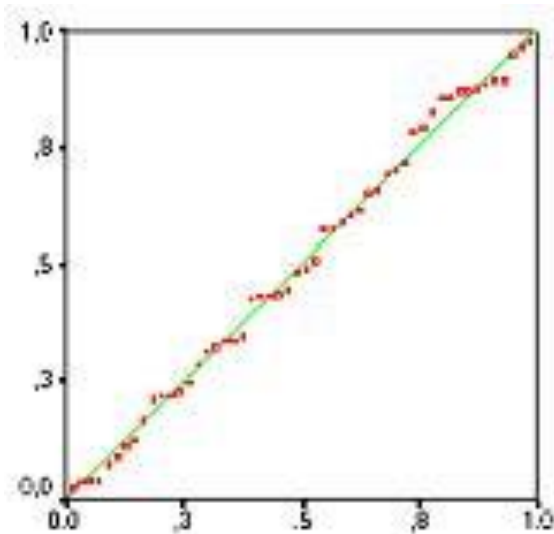


Figure 5.1.2: Q-Q Plot (Brown, 2012)

The null hypothesis for this test is: the distribution of the residuals is not normal.

The alternative hypothesis is: the distribution of the residuals is normal.

Failure to reject the null hypothesis satisfies this assumption.

4.10.4.4 Homogeneity

The last assumption the linear regression analysis makes is homogeneity. Homogeneity means that the variance between the groups should be approximately

equal (Statistics Solutions, 2013). This assumption has a variety of names: homogeneity of variance, homoscedasticity, uniform variance, etc. (cf. Chapter 5, section 5.2.1.1). A scatter plot is a good way to check whether homoscedasticity (that is the error terms along the regression are equal) is given (Statistics Solutions, 2013).

The method that this study used to test whether the assumption of homogeneity was met was through the use of the following *rule of thumb*: if the largest sample standard deviation divided by the smallest sample standard deviation is not greater than two, then assume that the population variances are equal (Statistics Solutions, 2013). Even if this assumption of homoscedasticity was violated, the researcher would not do a transformation since it could impact the relationships of the other independent variables with the dependent variable.

If the data is heteroscedastic the scatter plots looks like the following examples:

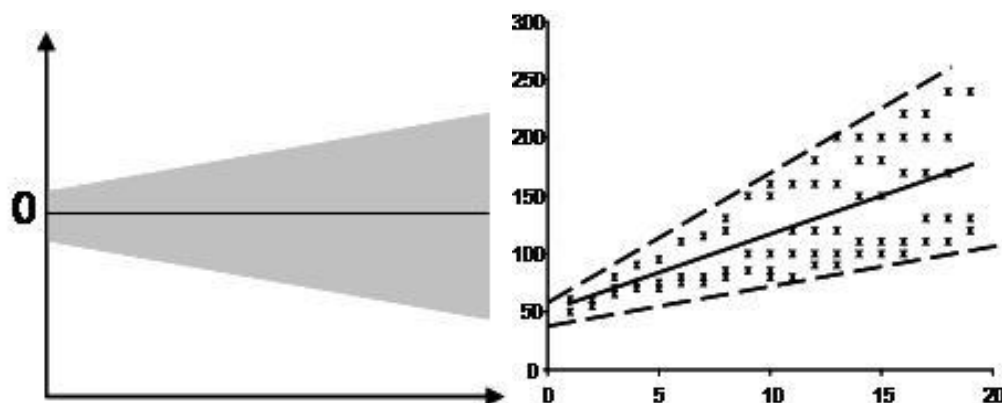


Figure 5.1.3: Heteroscedastic scatter plots (Statistics Solutions, 2013)

The Goldfeld-Quandt Test can test for heteroscedasticity. The test splits the data in high and low value to see if the samples are significantly different. If homoscedasticity is present, a non-linear correction might fix the problem.

The null hypothesis for this test is: the variance of the residuals is the same for all values of the independent variable (Statistics Solutions, 2013).

The alternative hypothesis is: the variance of the residuals is different for some values of the independent variable.

Failure to reject the null hypothesis satisfies this assumption.

4.10.5 Violation of ANOVA Assumptions

It is important to note that ANOVA is not robust to violations to the assumption of independence (Statistics Solutions, 2013). This is to say, that even if one violates the assumptions of homogeneity or normality, one can conduct statistical procedures that will still enable him or her to conduct the ANOVA, but one cannot with violations to independence. Statistics Solutions (2013) maintain that generally, with violations of homogeneity the study can probably carry on if one has equal sized groups. With violations of normality, continuing with the ANOVA should be ok if one has a large sample size and equal sized groups (*ibid*). In certain instances (*cf.* Chapter 5, section 5.2.2.1) in this research, the assumption of normality and homogeneity were violated, but the use of one way ANOVA validated the results obtained for the three hypotheses stated for this research.

4.10.6 General Purpose of ANOVA

Statistics Solutions (2013), state that the general purpose of ANOVA is twofold; omnibus ANOVA test, and multiple comparison tests.

4.10.6.1 Omnibus ANOVA test

In an ANOVA, a researcher first sets up the null and alternative hypothesis as this study has done. The null hypothesis assumes that there is no significant difference between the groups. The alternative hypothesis assumes that there is a significant difference between the groups (Statistics Solutions, 2013). After cleaning the data, the researcher tested the assumptions and to see if the data met them. The necessary calculation to calculate the F-ratio was done. After this, the researcher

compared the critical value of the F-ratio with the table value by simply looking at the p value against the established alpha (0.05). If the calculated critical value was greater than the table value, the null hypothesis was rejected and the alternative hypothesis was accepted. The results for hypothesis 1, 2, and 3 in this study are presented in (Chapter 5, section 5.2.5.2).

Rejecting the null hypothesis, the researcher concluded that the mean of the groups are not equal. If the calculated value is less than the table value, the researcher rejected the alternative hypothesis. This indicated to the researcher that there is a difference in what he was testing, but did not tell where the difference was. This is to say, if the researcher was testing several groups against one another, he or she would know that there is a difference between the means of the groups but not specify which individual groups are different.

4.10.6.2 Multiple comparison tests

When one runs an ANOVA, it is an attempt to determine if there is a statistically significant difference between the groups that is not related to sampling error. If one finds that there is a difference between the groups, it might mean that all groups might be different, or perhaps only one of the four groups is statistically different from the others (Statistics Solutions, 2013). In this study, the multiple comparison tests were not applied.

4.11 HYPOTHESIS TESTING

Hypothesis testing is a statistical method that is used in making statistical decisions using experimental data. Hypothesis Testing is basically an assumption that is made about the population parameter.

Using Statistics Solutions' (2013) procedure, the following factors were considered when testing the hypothesis:

Null hypothesis: Null hypothesis is a statistical hypothesis that assumes that the observation is due to a chance factor (*cf.* Chapter 1, section 1.5). Null hypothesis is denoted by $H_0: \mu_1 = \mu_2$, which shows that there is no difference between the two population means.

Alternative hypothesis: Contrary to the null hypothesis, the alternative hypothesis shows that observations are the result of a real effect (*cf.* Chapter 1, section 1.5).

Level of significance: Refers to the degree of significance in which one accepts or rejects the null-hypothesis. It is not possible to accept 100% accuracy, or reject a hypothesis. The researcher therefore selects a level of significance that is usually 5% as this study did.

Type I error: When one rejects the null hypothesis, although that hypothesis is true. Type I error is denoted by alpha. In hypothesis testing, the normal curve that shows the critical region is called the alpha region.

Type II errors: When one accepts a null hypothesis, which is false. Type II errors are denoted by beta. In Hypothesis testing, the normal curve that shows the acceptance region is called the beta region.

Power: Usually known as the probability of correctly accepting the null hypothesis. $1 - \beta$ is called power of the analysis.

One-tailed test: When the given statistical hypothesis is one value like $H_0: \mu_1 = \mu_2$, it is called the one-tailed test.

Two-tailed test: When the given statistics hypothesis assumes a less than or greater than value, it is called the two-tailed test.

4.11.1 Statistical decision for hypothesis testing

In statistical analysis, decisions about the hypotheses have to be made. These decisions include deciding if one should accept the null hypothesis or if one should reject the null hypothesis (Statistics Solutions, 2013). Every test in hypothesis testing

produces the significance value for that particular test. In Hypothesis testing, if the significance value of the test is greater than the predetermined significance level, then the alternative hypothesis is rejected. If the significance value is less than the predetermined value, then the null hypothesis is rejected. Statistics Solutions (2013) suggests that, if one wants to see the degree of relationship between two variables and the significance value of the correlation coefficient is greater than the predetermined significance level, then the alternative hypothesis can be rejected and conclude that there was no relationship between the two variables. However, due to the chance factor, it shows a relationship between the variables.

4.11.2 Elimination of Errors in Hypothesis Testing

A cut off to eliminate errors was a 1 - in – 20 probability: that means any result that would occur by chance only 5% of the time probably would not be due to chance but to another systematic factor that is influencing the data. The probability of 0.05 and in some instances was indicated, 0.01 was used as a significance level or alpha (α) to eliminate errors (Leedy and Ormrod, 2005). The results that were based on these criteria are deemed not to be due to chance but statistically significant (*cf.* Chapter 5, Table 7).

The researcher made it a point that he did not erroneously conclude that a result was not due to chance when in fact it was due to chance. Since statistical hypothesis testing was a matter of probabilities, where the researcher had a chance of making either Type I error (also called an *alpha error*) or Type II error (also called a *beta error*) (Leedy and Ormrod, 2005). The researcher could decrease the odds of making a Type I error by lowering his or her level of significance, from 0.05 to 0.01 or perhaps even lower. In the likelihood that he or she made a Type II error where he or she failed to reject a null hypothesis (H_0), the researcher would increase the level of significance. However, this would still increase the risk of Type I error (*ibid*). In Chapter 5, Table 7, the SPSS indicates a lowered level of significance denoted by

two asterisks next to each correlation value. This was an automated display since a two-tailed test was done.

4.12 NEGOTIATING ACCESS TO SCHOOLS

After being cleared by the University's Research Ethics Committee, a letter, which granted permission to conduct research at the designated school, was obtained from the Department of Education. A letter was then hand delivered to the principal of the school to request permission to conduct research at the school (see Appendix D). The respondents completed consent forms after their legal guardians were informed of the study (see Appendix A and B). The class teachers selected the suitable respondents according to the sampling criteria determined by the researcher.

4.13 DATA COLLECTION STAGES

The data collection process took place in two stages namely, the pilot study and the main study. The pilot study was conducted during the fourth week of March 2013 during study time after the normal teaching time. The main study was conducted during the third week of April 2013.

4.13.1 The Pilot Study

Govender (2007) says a pilot study is a small-scale study, which is conducted before the main study on a limited number of participants from the same population as the intended project. The function of the pilot study is to obtain information for improving the project or for assessing its feasibility (*ibid*). The purpose of the pilot study was to discover possible weakness, inadequacies, ambiguities, and problems in all aspects of the research so that they could be corrected before the actual data collection took place. It was also done so that the researcher was able to ensure content, and face validity and to improve the questions that he or she was going to ask the chosen

respondents. The two terms that needed clarity were Internet services and smart phones. In summary, the following are the lessons learnt from the pilot study.

The researcher was able to:

Estimate the costs and duration of the main study and test the effectiveness of its administration. Test the research methods, research instruments, and their suitability. Determine the adequacy of the sampling frame. Familiarise himself with the research environment. Get an opportunity to practise research in a real situation and before the main study began. However, the response rate was 66.7% (ten questionnaires returned) with many non-responses and as a result, the researcher struggled in analysing the data and deciding on the items to remove or add to the questionnaire. Because of the time constraint, the researcher had to proceed with the main study.

The Cronbach's Alpha and Inter-item correlation mean were used to check the reliability of the questions. For each construct, the researcher had more than one question; therefore using Cronbach's alpha was appropriate. The pilot study was conducted with 15 learners (i.e. 5 learners from Grade 10, 5 learners from Grade 11, and 5 learners from Grade 12). Responses were collected using a self-administered questionnaire.

4.13.2 Measures to ensure a high response rate

Different measures were taken by the researcher to ensure a high response rate. Adams *et al.*, (2007) state that, the failure of most surveys is caused by poor response by the respondents. In this study, the response rate was 40.6 %.

The researcher considered the following factors in order to raise the response rate:

- (a) Made the survey interesting by providing a covering letter that made respondents understand the background and purpose of the research (*cf.* Appendix A).

- (b) Contacted the respondents and gatekeepers to ask for cooperation (*cf.* Appendix C and D).
- (c) Kept the questions short, simple, and interesting (*cf.* Appendix E).
- (d) Narrowed the research questions to cover required sub-questions.
- (e) Avoided questions that require calculations and exact answers in favour of those that want respondents to draw from their experiences only.
- (f) Tried to enhance commitment by avoiding indecision answers like “Not Sure/Not Really, in the Likert scales.
- (g) Spelt out issues of confidentiality (*cf.* Appendix B).
- (h) Made sure the questionnaire was professionally presented in clean and well – typed paper.

4.13.3 The Main Study

4.13.3.1 Time

The questionnaires for the main study were administered during the month of April 2013 after school hours. The learners took two weeks to return 116 questionnaires. In cases where respondents did not have enough time to fill in the questionnaires and return them, another day was set to collect the completed questionnaires. However, there was not enough cooperation from the teacher who was assigned by the principal to distribute and collect questionnaires. Hence, the researcher could only get 116 questionnaires from Grade 11, out of 286 questionnaires, which were given to the respondents.

The researcher had to also adhere to the following conditions as stipulated in the letter of permission to undertake research from the Department of Education. Research should not be conducted during official contact time, as teachers’ programmes should not be interrupted. The research should not be conducted during the fourth school term, except in cases where a special motivated request is received by the Department of Education.

4.13.3.2 Venue

The respondents who filled in the questionnaires were selected by the teacher who was delegated by the principal to do so. The questionnaires were filled in at home after the official contact time in compliance with the DoE's requirements. The class teachers were responsible for the distribution of questionnaires and explanation of how to go about filling them. The principal did not allow the researcher some time to be in contact with the respondents, as this was not allowed during teaching time. The class teachers were the only channel through which the researcher communicated with the respondents regarding issues of clarity.

4.14 VALIDITY OF DATA IN QUANTITATIVE RESEARCH

Quantitative researchers attempt to design in advance controls that deal with anticipated and unanticipated threats to validity. They design research instruments with careful control and use control groups, randomised sampling, statistical control of variables, and tests for statistical significance to ensure replication of the results (Maxwell, 2005:107).

Jupp (2006:311) defines validity as “the extent to which conclusions drawn from research provide an accurate description of what happened, or a correct explanation of what happens and why”.

Mugenda and Mugenda (2003:90) maintain that, a major concern in quantitative research is the validity of the procedures and conclusions. According to Gay and Airasian (2000:42), “validity is that quality of a data gathering instrument or procedure that enables it to measure what it is supposed to measure”. The idea of validity rests on the extent to which research data and the methods for obtaining data are deemed accurate, honest and on target (Descombe, 2000:241).

In quantitative research design, validity rests on the data collection and analysis techniques (McMillan & Schumacher, 2001:407). There are various types of validity, *inter alia* face, content, criterion validity, and construct validity (Mugenda & Mugenda, 2003:80).

4.14.1 Face Validity

Face validity is less systematic than content validity as it checks if a questionnaire tests what it is supposed to test (Saunders *et al.*, 2007:386). In the current study, the researcher gave the instrument to an expert to check its face validity. The expert checked on the face value, whether the questionnaire tested performance expectancy, effort expectancy, social influence, facilitating conditions, behavioural intention, price value, perceptions, and persistent use.

4.14.2 Content Validity

Content validity is the extent to which the measurement device like a questionnaire provides adequate coverage of the investigative questions (Saunders *et al.*, 2007:366). Mugenda and Mugenda (2003:100) define validity as a measure of the degree to which data collected using a particular instrument represents content of a particular concept. Content validity involves confidence that items comprising the measuring instrument are representative of the field, which they intend to serve (Crowe, 2004:123). In this study, the adequacy with which an instrument covered the appropriate content (determinants of Internet services' adoption and application) determines the content validity. This was adhered to by reviewing items in the measuring instrument to ensure that they are representative of the determinants of Internet services' use by learners.

In order to determine content validity, the researcher specified the domain of variables under investigation. In the questionnaire, the researcher included items on computer self-efficacy, computer anxiety, performance expectancy, and effort

expectancy. In addition to the five socio-demographic variables, the questions addressed the aims, research questions and hypotheses of the study as a way of ensuring content validity. In order to enhance content validity, the researcher subjected the instruments to the scrutiny of the research supervisor. The instruments were also pre-tested in a pilot study.

4.14.3 Construct validity

Construct validity refers to the degree which a variable measures what it was intended to measure (Straub, Boudreau, & Gefen, 2004). To prove construct validity both convergent and discriminate validity must be proven. Convergent validity is degree which similar constructs are related; while discriminate validity is, the degree that different constructs differ from one another. To determine convergent validity, the professionals in the field of Information Systems who publish in this area, reviewed this survey items. In addition, the instrument was pre-tested as recommended by Straub (Straub *et al.*, 2004). The statements included in the instrument were based on statements contained in seminal works of technology acceptance.

4.14.4 Quality criteria

Research is very sensitive because it produces answers to questions that researchers and society have but the biggest problem is that respondents in social research are mere human capable of being biased or influenced by the researcher (who is also human) and by prevalent ideological trends (Maree, 2007). For example, the Hawthorn effect is one element that can distort research results as the 'atmosphere of research' influences respondents' views as if they are in an examination. Some responses lack validity and reliability because of this Hawthorn effect.

Another problem is that of 'acquiescent response set' (Adams *et al.*, 2007) where respondents have a tendency of answering 'Agree' to most items because by human nature it is easy to say 'yes' (even if one does not mean it!) than to say 'no'. This too affects response validity and reliability. Content validity and response reliability compromised by both the Hawthorn effect and the 'acquiescent response set' was ascertained by joint efforts of the supervisor of the researcher and by the pilot study. Unnecessary items were eliminated in favour of necessary and relevant items. Several items, which anticipate disagreement, were included to counteract the tendency to agree even in places where people must obviously disagree. The "not sure" category was deliberately avoided to encourage all respondents to commit themselves to the study (*cf.* Appendix E).

4.15 RELIABILITY TEST USING INFERENCE ANALYSIS

Reliability refers to "the extent to which research findings can be replicated in another enquiry" (Merriman, 2009:205). Reliability in technology acceptance models refers to the degree, which the variables, or indicators, are stable and consistent with what they are supposed to be measuring (Singleton & Straits, 2004). This is only possible if the procedures followed are carefully documented and if the same procedure is followed in each school.

In general, the commonly used measure of internal consistency is Cronbach's alpha. 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 learners' responses rendered the questionnaire to be reliable and consistent except for facilitating conditions. Cronbach's alpha reliability scores are shown in Chapter 5 in Table 8, 9, 12, 14, and 16 for all the independent variables. Generally reliability numbers greater than 0.6 are considered acceptable in technology acceptance literature (Keegwe & Wachira, 2008)

4.16 ETHICAL MEASURES

Ethics are the basis upon which the researcher has to evaluate his or her conduct. The researcher is obliged to behave in a professional and responsible way. Ethics are usually determined to deal with beliefs concerning what is right or wrong, appropriate or inappropriate, moral or immoral (McMillan & Schumacher, 2001).

4.16.1 Ethical clearance

Ethical clearance for this study was obtained from the Higher Degrees Committee at the University of Fort Hare, permitting the researcher to commence the research in the East London School District.

4.16.2 The Research Site

Creswell (2008:12) describes the need to honour research sites, saying it is important to respect the site where research takes place. Respect was shown by requesting permission before entering a site. During this study, permission was requested from the DoE first and later from the principal. In addition, the researcher was advised to disturb as little as possible during the study, and viewing oneself as a guest at the place of study. In this study, approaching of the gatekeepers was the first step. This was to approach the Department of Education. Permission was requested from the principal who approved the questionnaire with the parents. The researcher disclosed his identity, credentials, and purpose of the research. This was done to enhance cooperation and trust from the respondents. People work freely with people they know and trust (Brown, 2009). Teaching schedules and school timetables were respected and the study did not interfere with teachers' commitments to teaching practice.

A form that requested permission from the Department of Education to conduct research at the selected school was submitted in advance. The access letter from the University of Fort Hare was personally delivered to the principal of the selected school, requesting permission to conduct the study at the school.

4.16.3 Informed Consent

Informed consent implies that “all possible or adequate information on the goal of the investigation, the procedures which would be followed during the investigation, the possible advantages or disadvantages, the dangers to which respondents may be exposed, and the credibility of the researcher be furnished to potential respondents or their legal representatives” (Strydom, 2000:25). To obtain the respondents’ consent, the aims and the rationale behind the research were explained verbally and in writing so that the respondents had a chance to make an informed decision on whether they wished to take part in the research. Following Strydom’s (2000) system, the researcher gave the respondents a consent form to sign in order to show their willingness to participate in the study. The respondents were not in any way forced to participate in the study. They were made aware that they have the right to withdraw from the study at any point without having to specify any reasons for doing so. The researcher obtained consent when dealing with vulnerable groups, such as learners under the age of 18 years. In both the pilot study and the main study, the required authorities completed informed consent forms.

4.16.4 Guaranteed Anonymity and Confidentiality

Guaranteed “anonymity must be respected and the researcher must obtain signed consent forms, which must be treated with discretion” (McMillan and Schumacher, 2001:421). The respondents were informed that the information they gave would be treated as confidential. The respondents’ names and signatures on the consent form showed that they were not forced but agreed to participate in the study. It was

explained further that the consent forms and the questionnaires would not be linked in any way; therefore, the responses they gave be anonymous. The respondents were made aware that the researcher's supervisor would see the data but they would not be linked to their responses.

4.16.5 Harm, Caring and Fairness

In compliance with McMillan and Schumacher (2001), the respondents were protected from experiences of humiliation or violation of interpersonal trust. The researcher's thinking and activities were underpinned by a sense of caring and fairness for the respondents. The researcher was open for discussion with any respondents in respect of activities or information shared; the nature of which might have been a cause for concern to the respondents. The study did not pose any foreseeable risks and physical, psychological, or emotional harm to the respondents. The respondents did not have to pay for taking part in the study, financially or in any other way.

It was explained that the participation in the study would benefit the respondents in that they would bring to the surface the challenges they encounter, which the researcher would communicate anonymously to the management and any interested stakeholder. This would be done in a form of a report. This would then assist in the provision of special education support services if necessary. Respondents did not risk losing life or limb, and were not subjected to unusual stress, embarrassment, or loss of self-esteem. In cases where the nature of the study involved creating a small amount of psychological discomfort, the respondents would be informed ahead of time, so that necessary debriefing or counselling would follow immediately after their participation (McMillan & Schumacher, 2001).

4.16.6 Privacy

Privacy is that which is normally not intended for others to observe or analyse (Babbie, 2007). The right to privacy is individual's right to decide when, where, to whom, and to what extent his or her attitudes, beliefs and behaviour will be revealed. Under no circumstances would a voice recorder be used without the knowledge and written consent of the research respondents. Under no circumstances has the research report, either oral or written, been presented in such a way that others become aware of how a particular respondent had responded or behaved, unless the respondent has specifically granted permission, in writing, for this to happen (Babbie, 2007).

4.16.7 Reporting Research Fully and Honestly

The researcher reported his findings in a complete and honest fashion without misrepresenting what he did or intentionally misleading others about the nature of his findings (*cf.* Chapter 5 and 6). Under no circumstances did the researcher fabricate data to support a particular conclusion, no matter how seemingly noble that conclusion would be (Creswell, 2008). Data has been reported honestly and fully without changes to possibly satisfy certain predictions or interest groups. Further, this ethic required the researcher to "make every effort to communicate the practical significance of the research to the community of researchers and practitioners so that the inquiry would be encouraged" (Creswell, 2008:13).

4.16.8 Plagiarism

There is a branch of law known as intellectual property. This field is based on the idea that original work, speeches, publications, and artistic creations are not free for taking (Creswell, 2003). The researcher acknowledged all sources used to further

this investigation. To avoid plagiarism, the writing and the data collection instruments had to be original although inspiration by other researchers could not be avoided.

4.17 CONCLUSION

Personal ideology on epistemology and ontology influence research paradigms and designs that a researcher chooses in the field. This also means that the types of questions that one asks are influenced by one's personal philosophy of what knowledge is. This chapter explained how the researcher chose his research paradigm and design, to answer the research questions. The researcher also arrived at his paradigm through conviction by personal philosophy of what constitutes knowledge.

The next chapter will discuss the findings of the literature review and the empirical study in order to draw conclusions and make recommendations and suggestions for further research.

CHAPTER 5

DATA PRESENTATION AND ANALYSIS

5.0 INTRODUCTION

This chapter presents the statistical analysis of the information received from the survey in East London among high school learners, which was undertaken to investigate the determinants of Internet services' adoption and application among learners. The information obtained from the questionnaires administered to the respondents at the school, has been presented and analysed from section 5.1 of this chapter.

5.0.1 Synopsis of the Main Research Questions and Hypotheses

5.0.1.1 What is the effect of performance expectancy on the learners' intention to adopt and use Internet services?

H_{a1}: Performance expectancy will affect the learners' intention to use Cloud computing.

H₀₁: Performance expectancy will not affect the learners' intention to use Cloud computing.

This research question aimed to determine the influence of performance expectancy on the learners' intention to adopt and use Internet services. To answer this question the Pearson correlation coefficient was executed to discover the correlations among various performance expectancy sub variables and their significance at the required level of $p < 0.05$ (*cf.* Table 7). A one way ANOVA was conducted to test the hypothesis (the effect of performance expectancy on behavioural intention).

5.0.1.2 What degree of variation exists for effort expectancy on learners' intention to adopt and use Internet services?

H_{a2}: Effort expectancy will affect the learners' intention to use Internet services.

H₀₂: Effort expectancy will not affect the learners' intention to use Internet services.

Through this research question the study sought to determine the extent of variation that exists for effort expectancy on learners' intention to adopt and use Internet services. To answer this question the Pearson correlation coefficient was executed to discover the correlations among various effort expectancy sub variables and their significance at the required level of $p < 0.05$. A one way ANOVA was conducted to test the hypothesis (the effect of effort expectancy on behavioural intention).

5.0.1.3 How much of the determinants explain the usage of Internet services?

This research question was meant to explain the extent to which the envisaged determinants (performance expectancy, effort expectancy, social influence, and facilitating conditions) explained the usage of Internet services by using the standardised beta coefficient from multiple regression analysis (cf. Table 10).

5.0.1.4 Which is (are) the best predictor of Internet services' usage given a set of determinants?

To address this question, a multiple linear regression model was used to calculate the best predictor of Internet services' usage given a set of determinants. The main determinants in this study were performance expectancy, effort expectancy, social influence, and facilitating conditions (cf. Table 20 under list of tables).

5.0.1.5 What is the effect of confounding variables (if any) on Internet services' adoption and usage?

A one-way ANOVA was conducted to determine the effect size of confounding variables (internet self-efficacy, respondents' demographics, and Internet experience) (cf. Chapter 5, Table 11, 13, and 15). The effect of the social influence

on behavioural intention as hypothesised below was tested by conducting a one way ANOVA (cf. Chapter 5, Table 19).

H_{a3}: Social influence plays a positive role on Internet services' adoption and use.

H₀₃: Social influence does not play a positive role on Internet services' adoption and use.

5.0.1.6 Which model can be designed based on the best predictor(s) of Internet services' adoption and usage for secondary school learners?

In order to answer this question, the researcher used perceptions, persistent use, and the price of Internet to design the AATL model (cf. Chapter 5, Figure 6). Perceptions, persistent use, and the price of Internet are the variables that were adapted by the researcher to the UTAUT to address the adoption and use of Internet services in a school context. These variables were measured by asking nine questions (three items per variable) using a 4-point Likert scale ranging from strongly agree to strongly disagree (cf. Appendix E).

5.0.2 Data analysis technique(s) per each research question and hypothesis

The main purpose of the study was to investigate the determinants of Cloud computing adoption and use amongst the learners in order to design a contextual model. As a result, this analysis was mainly descriptive and inferential in nature.

5.0.2.1 Testing the assumptions of the regression analysis

In order to conclude whether the assumptions were met, this section of the study tested the three linear regression assumptions in the following manner (Statistics Solutions, 2013):

(a) Linearity

This study confirmed linearity between independent variables and dependent variables by using the lack of fit test. The independent variables were:

- To use Internet for learning purposes would save me a lot of time.
- To use Internet for learning purposes would enhance the effectiveness of my learning.
- Mobility enables me to accomplish tasks quickly.
- Mobile devices are also mediums for learning.
- Unexpected problems could be fixed at the first time of using internet devices.
- I would feel more interested in study if I could use Internet devices.
- I would be entertained in my study when using Internet devices.
- Internet would ease my learning because it allows me to study anytime, anywhere.
- I would be more encouraged to learn if I could access materials anytime anywhere via mobile devices.
- It would be more desirable to use mobile devices as a way for learning.

Lack of fit test is a hypothesis test of whether the pattern between the variables is linear, or a higher order polynomial term (square or cube) is needed in the regression equation. The results for all the linear regression assumptions for all the research questions are presented in the same chapter from section 5.2.1.1.

(b) Independence of cases

In testing the independence of cases, the Durbin-Watson statistic was used. The value of the Durbin-Watson statistic ranges from 0 to 4. As a general rule of thumb, the residuals are not correlated if the Durbin-Watson statistic is approximately 2, and an acceptable range is 1.50 - 2.50.

(c) Normality

In evaluating normality, this study used the skewness to check if values obtained were both within the range of acceptable values from -1.0 to +1.0.

(d) Homogeneity

The method that this study used to test whether the assumption of homogeneity was met was through the use of the following rule of thumb: if the largest sample standard deviation divided by the smallest sample standard deviation is not greater than two, then assume that the population variances are equal (Statistics Solutions, 2013). Even if this assumption of homoscedasticity were violated, the researcher would not do a transformation since it could affect the relationships of the other independent variables with the dependent variable.

5.0.2.2 Descriptive Statistics

Descriptive statistics has been presented in the form of tables for all the objectives of the study, i.e. to determine the effect of performance expectancy on the learners' intention to adopt and use Cloud computing (first objective). To determine the degree of variation that exists for effort expectancy on learners' intention to adopt and use Cloud computing (second objective). To establish how much of the determinants explain the usage of Cloud computing (third objective). To discover the best predictor(s) of Cloud computing usage, given a set of determinants (fourth objective).

To determine, the effect of confounding variables, on Cloud computing adoption and usage (fifth objective). To design a model based on the best predictor(s) of Cloud computing adoption and usage for secondary school learners (sixth objective).

The statistics showed percentages, frequencies, means and standard deviations out of the total sample for each category in the questionnaire. The descriptive statistics are based on the total sample. In some cases, the respondents did not indicate their response on a statement. These non-responses are also included and are indicated as NR (no response). A broad descriptive analysis was done across all the available data to establish whether or not some general patterns could emerge using the SPSS.

5.0.2.3 Inferential Statistics and Reliability Testing

Section A (Appendix E) consisted six questions that focused on demographic information of learners: gender, age, grade, residential area, the kind of Internet devices they have, and major subjects taken at school. This data analysis technique was used to obtain crucial information on whether age, gender and mostly social influence have any positive role to play on the learners' adoption and use of Cloud computing. Besides this, the statistics was intended to answer research question number three, and to test the third alternative hypothesis. Section B was designed to obtain information on the ability of learners in using the Internet, which might influence their future use (behavioural intention). The statistics were intended to answer research question number five, which sought to investigate the effect of confounding variables on Cloud computing adoption and usage.

Section C focused on the learners' use of Internet for learning purposes, in this section they had to tick all the activities they have done before. This information was acquired in order to establish the level of experience the learners have in using Internet devices for learning. Section D, which contained 30 items focused on performance expectancy, effort expectancy, perceptions, price of Internet, persistent

use, and behavioural intention. Information obtained in this section was intended to answer research question number one and research question number two (the effect of performance expectancy and effort expectancy on Cloud computing adoption and use). The statistics in this section helped the researcher in deciding which hypothesis to keep and which hypothesis to drop between the first hypothesis and the second hypothesis.

Section E of the questionnaire contained three items which addressed the usage frequency of SMS, MMS, ringtone and logo download by learners. The information obtained from these items was intended to assist the researcher in determining the purpose for which the Internet devices are mostly used.

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.

5.0.2.4 Reliability test

The reliability test (Cronbach's Alpha Coefficient) on all the main items, which represent the measuring instrument of this survey, with respect to the learners' responses, rendered the questionnaire to be reliable and consistent. The reliability measurements obtained for the five sections of the instruments were $\alpha = 0.987$ (performance expectancy), $\alpha = 0.878$ (effort expectancy), $\alpha = 0.857$ (Internet self-efficacy), and $\alpha = 0.834$ (experience in using Internet devices).

The data analysis in this chapter is structured into two sections: the first section provides a summary tabulation of the respondents' profile, which reflects basic demographics such as gender, age, grade level (*cf.* section 5.2.5). The other part of the first section provides frequency tables summarising the major subjects studied by respondents, and Internet device ownership (*cf.* section 5.1.2). In the second

section, the data is presented in relation to hypotheses and research questions posed in this chapter under section 5.2.1. The reason for analysing data in this chapter per research question and hypothesis was to ensure that the questionnaire is reliable and consistent.

5.1 THE DEMOGRAPHIC INFORMATION OF RESPONDENTS

This section focuses on the respondents' demographics and how they affect the main constructs (performance expectancy, effort expectancy, social influence, and facilitating conditions) towards the intention to adopt and use Cloud computing. The respondents' demographics relate to research questions one to five. Age and gender have been conceptualised to moderate the effect of the main constructs of the UTAUT on behavioural intention (*cf.* Chapter 1, section 1.4).

The demographic information of respondents contains background information, including gender, age, school grade, residential background of learners, ownership of smart mobile devices, and major subjects studied at school.

The number of female respondents represented 59%, whereas male respondents were less than females, representing 41%. The questionnaires were supposed to be distributed among Grades 10, 11, and 12 learners at the school but the researchers ended up collecting 116 questionnaires from only Grade 11 learners.

5.1.1 Administration of Questionnaire, Data Collection, and Response Rate

The questionnaire was distributed to 286 respondents in one school, and a total number of 116 valid questionnaires were collected. The response rate on collection was 40.6%, and this response rate was far lower than anticipated. Achieving a high return rate is a persistent problem in educational research involving questionnaires. Fogelman (2002:106) suggests that due to increasing pressure on schools and teachers, a mere 60% response rate for a questionnaire is currently considered to be

quite acceptable while Cohen, Manion and Morrison (2000:263) suggest that a typical response rate on first attempt would be 40%, with the potential to rise to 75% with subsequent follow up. Response rates are clearly partly to do with the inclination and ability of those being surveyed to respond irrespective of researchers actions but as Cohen and colleagues point out 'following up' might remind us, response rates can also be helped or hindered by the strategies employed by researchers. This means that even an apparently 'basic' research task like distributing a questionnaire will raise numerous issues for researchers since the specific approach employed can make a significant difference to the success or otherwise of a research project.

However, it should not be inferred that the lower return rate achieved at the school was reflective of the efforts of the school head. It merely suggests that the communication channels among the delegated class teachers and the parents were compromised and that had a negative effect on the study.

It took approximately two weeks to deliver and to collect questionnaires at the school. The process of collecting the questionnaires for the main study took part in one stage. As the researcher picked up the questionnaires, he was able to review the state of play and left a letter for the principal, thanking them for their efforts and noting the number of questionnaires, which were yet to be returned. The letter stated that, any remaining questionnaires be collected and kept safe. The researcher would then call the school for collection if any questionnaires were not returned. These efforts did not yield any results, and the response rate remained at 40.6%

Table 5: *Major subjects studied by respondents*

Major subjects studied	Frequency	Percent (%)
EMS	54	46.6
HSS	17	14.7
SM	45	38.8
Total	116	100.0

For major subjects in Table 5, learners studying Economic and Management Sciences, Science and Mathematics, are dominant, 46.6% and 38.8% respectively. Therefore, the majority of Grade 11 learners at the school studied Economic and Management Sciences. Respondents from the townships surrounding the school constituted 88.8%, from town 9.5%, and from the rural areas 1.7%.

5.1.2 Internet device ownership

This section focuses on Internet device ownership as a variable that might influence the learners' adoption and use of Cloud computing. An Internet device is a multimedia-capable device providing Internet access (Forward Concepts, 2008). They are designed to provide entertainment, information and location-based services for personal use, rather than for corporate use. They allow 2-way communication and real-time sharing. This variable relates to research question number five, which seeks to determine the effect of confounding variables on Cloud computing adoption and usage.

The ownership of Internet devices is shown in Table 6 with 85 out of 116 respondents owning smart phones. A smartphone is a mobile phone that includes advanced functionality beyond making phone calls and sending text messages. Most smartphones have the capability to display photos, play videos, check and send e-mail, and surf the Web (Behrend *et al.*, 2011). The number of learners with none of any Internet device was 11, which is comparably a very small amount, provided that

the total sum was 116. Only two respondents in this study owned a Touch Pad and if more learners would own one, they would be amazed at how it could revolutionise the way they access educational information. The following figures on Internet device ownership point to the fact that there is a lack of infrastructure that is suitable to facilitate e-learning. With reference to the fourth construct of UTAUT (facilitating conditions), learners are in a dire need for appropriate Internet devices that will facilitate their learning, both in the classroom and outside the classroom.

Table 6: *Internet Device Ownership*

Internet devices	Frequency	Percent (%)
None	11	9.5
Smart mobile phone	85	73.3
Touch Pad	2	1.7
Computer	14	12.1
Two devices	4	3.4
Total	116	100.0

5.2 RESEARCH QUESTIONS AND STATISTICAL FINDINGS

Pearson correlation was used in order to see how it reflects the degree of linear relationship between two variables. As it was mentioned in Chapter 4, a correlation ranges from +1 to -1. A correlation of +1 means that there is a perfect positive linear relationship between variables, while a correlation of -1 means that there is a perfect negative linear relationship between variables. A correlation of 0 means there is no linear relationship between the two variables. Correlations are rarely if ever 0, 1, or -1 (Leedy and Ormrod, 2005). The sizes of correlations to indicate the ranges of largeness, the smallness or the moderateness were regarded as follows (Cohen, Manion, and Morrison, 2007):

- (a) Small: $r = 0.1$ to 0.3
- (b) Moderate: $r = 0.4$ to 0.6
- (c) Large: $r = 0.7$ to 0.9
- (d) Perfect correlation: $r = 1$

Research Question # 1

5.2.1 What is the effect of performance expectancy on the learners' intention to adopt and use Cloud computing?

The following results represent the learners' responses to questions that relate to performance expectancy. Performance expectancy was measured using the following ten sub variables and Responses given on a 4-point Likert scale ranging from strongly disagree to strongly agree. The correlation statistics for performance expectancy from which the following results were obtained is found under the list of tables.

A correlation analysis was conducted to determine the level of relationship between the use of Internet for learning purposes, which would save the respondents a lot of time and will stimulate their interest to study because of the use of Internet devices. It was found that there is a large positive relationship [$r(116) = +0.988, p < 0.05$] between the use of Internet for learning purposes which would save the respondents a lot of time, and more interest in study because of the use of Internet devices.

A correlation analysis was conducted to determine the strength of association between the respondents' knowledge that Internet use for learning purposes would enhance the effectiveness of their learning, and is more entertaining. There was a large positive relationship [$r(116) = +0.989, p < 0.05$] between the respondents' knowledge that Internet use for learning purposes would enhance the effectiveness of their learning, and more entertainment in study when Internet devices are used.

Pearson correlation analysis was conducted to determine the level of association that exists between the mobility, which enables the learners to accomplish tasks quickly, and more desire to use mobile devices as a way of learning. The results portrayed a large positive correlation [$r(116) = +0.960, p < 0.05$] between the mobility

which enables the learners to accomplish tasks quickly and more desire to use mobile devices as a way of learning.

A correlation analysis was conducted to determine the strength of association between the respondents' knowledge that mobile devices are also mediums for learning, and the use of Internet for learning purposes, which would save them a lot of time. There was a moderate positive relationship found [$r(116) = +0.638, p < 0.05$] between the respondents' knowledge that mobile devices are also mediums for learning and the use of Internet for learning purposes which would save them a lot of time.

Pearson correlation analysis was conducted to determine the level of association that exists between the fixing of unexpected problems at the first time of using Internet devices, and more desire to use mobile devices as a way of learning. The study found a large positive correlation [$r(116) = +0.954, p < 0.05$] between the fixing of unexpected problems at the first time of using Internet devices, and more desire to use mobile devices as a way of learning.

A correlation analysis was conducted to examine the strength of association between the ease of the learners' learning associated with studying anytime and anywhere, and the entertainment in studies when Internet devices are used. A large positive relationship was found [$r(116) = +0.985, p < 0.05$] between the ease of the learners' learning associated with studying anytime and anyplace, and the entertainment in studies when Internet devices are used.

A correlation analysis was conducted to examine the strength of association between the learners' encouragement to learn if they could access materials anytime and anywhere via mobile devices, and the use of Internet for learning purposes in enhancing the effectiveness of their learning. A large positive relationship was found [$r(116) = +0.983, p < 0.05$] between the learners' encouragement to learn if they

could access materials anytime and anywhere via mobile devices, and the use of Internet for learning purposes in enhancing the effectiveness of their learning.

A correlation analysis was conducted to examine the strength and direction of correlation between the learners' knowledge that mobile devices are also mediums for learning, and the mobility, which enables respondents to accomplish tasks quickly. A large positive correlation was found [$r(116) = +0.958$, $p < 0.05$] between the learners' knowledge that mobile devices are also mediums for learning, and the mobility which enables learners to accomplish tasks quickly.

Table 7: *Correlations for Performance Expectancy sub variables*

		PE1	PE2	PE3	PE4	PE5	PE6	PE7
PE1	Pearson	1	.884**	.740**	.638**	.815**	.988**	.889**
	Correlation							
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000
	N	116	116	116	116	116	116	116
PE2	Pearson	.884**	1	.890**	.846**	.924**	.891**	.989**
	Correlation							
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000
	N	116	116	116	116	116	116	116
PE3	Pearson	.740**	.890**	1	.958**	.921**	.759**	.873**
	Correlation							
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000
	N	116	116	116	116	116	116	116
PE4	Pearson	.638**	.846**	.958**	1	.894**	.658**	.827**
	Correlation							
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000
	N	116	116	116	116	116	116	116
PE5	Pearson	.815**	.924**	.921**	.894**	1	.824**	.909**
	Correlation							
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000
	N	116	116	116	116	116	116	116
PE6	Pearson	.988**	.891**	.759**	.658**	.824**	1	.895**
	Correlation							
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000
	N	116	116	116	116	116	116	116
PE7	Pearson	.889**	.989**	.873**	.827**	.909**	.895**	1
	Correlation							
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	
	N	116	116	116	116	116	116	116
PE8	Pearson	.894**	.984**	.864**	.803**	.890**	.903**	.985**

PE9	Correlation							
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000
	N	116	116	116	116	116	116	116
PE10	Pearson	.859**	.983**	.904**	.866**	.929**	.881**	.971**
	Correlation							
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000
PE10	N	116	116	116	116	116	116	116
	Pearson	.750**	.926**	.960**	.929**	.954**	.774**	.906**
	Correlation							
PE10	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000
	N	116	116	116	116	116	116	116

** . Correlation is significant at the 0.01 level (2-tailed).¹

George and Mallery (2003:231) provide the following rules of thumb for Cronbach's reliability statistics: " $\alpha > 0.9$ = Excellent, $\alpha > 0.8$ = Good, $\alpha > 0.7$ = Acceptable, $\alpha > 0.6$ = Questionable, $\alpha > 0.5$ = Poor, and $\alpha < 0.5$ = Unacceptable". While increasing the value of alpha is partially dependent upon the number of items in the scale, it should be noted that this has diminishing returns. It should also be noted that an alpha of 0.8 is probably a reasonable goal. It should also be noted that while a high value for Cronbach's alpha indicates good internal consistency of the items in the scale, it does not mean that the scale is unidimensional.

In Table 8, the alpha value of this size, ($\alpha = 0.987$) indicates that the sub variables asked (in Table 7) in the questionnaire are reliable and consistent pertaining to the sample and performance expectancy. Above that, the results obtained are positive and meet the requirements and the assumptions of the regression model.

¹ PE1 = The use of Internet for learning purposes would save me a lot of time. PE2 = The use of Internet for learning purposes would enhance the effectiveness of my learning. PE3 = Mobility enables me to accomplish tasks quickly. PE4 = I know that mobile devices are also mediums for learning. PE5 = Unexpected problems could be fixed at the first time of using Internet devices. PE6 = I would feel more interested in study if I could use Internet devices. PE7 = I would be entertained in my study when using Internet devices. PE8 = Owning an Internet device would ease my learning because it would allow me to study anytime, anyplace. PE9 = I would be more encouraged to learn if I could access materials anytime anywhere via mobile devices PE10 = I would have more desire to use mobile devices as a way for learning.

Table 8: *Reliability Statistics for Performance Expectancy sub variables*

Cronbach's Alpha	Cronbach's Alpha Based on Standardised Items	No. of Items
0.987	0.987	10

5.2.1.1 Linear Regression assumptions and correction of violations

(a) Linearity

In the lack of fit test (*cf.* list of tables), the probability of the F test statistic ($F = 0.399$) was $p = 0.979$, greater than the alpha level of significance of 0.05. The alternative hypothesis that "a linear regression model is appropriate" was not rejected. The null hypothesis that "a linear regression model is not appropriate" was not supported by this test. In other words, failure to reject the alternative hypothesis satisfied the assumption of linearity.

(b) Independence

The Durbin-Watson statistic for this problem is 2.17, which falls within the acceptable range from 1.50 to 2.50 (*cf.* list of tables). The analysis satisfied the assumption of independence of errors.

(c) Normality

In evaluating normality for performance expectancy, this study used the skewness statistics to check if values obtained were both within the range of acceptable values from -1.0 to +1.0. The values obtained met this assumption of normality.

The alternative hypothesis that "the distribution of the residuals is normally distributed" was not rejected. The acceptance of the alternative hypothesis in this study satisfied the assumption of normality of errors.

The research hypothesis that "the distribution of the residuals is not normally distributed" was not supported.

(d) Homogeneity

The largest sample standard deviation (1.47310) divided by the smallest sample standard deviation (1.22015) is not greater than two (1.21). Therefore, the assumption that the population variances are equal has been met.

Performance expectancy met all the four linear regression assumptions as discussed. Since there were no violations, this independent variable was found to be influential on the learners' intention to adopt and use Cloud computing (*cf.* section 5.2.1 and 5.3.1).

Research Question # 2

5.2.2 What degree of variation exists for effort expectancy on learners' intention to adopt and use Cloud computing?

The following results represent the learners' responses to questions that relate to effort expectancy. Effort expectancy was measured using the following eight sub-variables.

- (a) Internet use for learning would be everywhere and useful.
- (b) Mobility enables me to access real-time data.
- (c) I would like to be able to launch a discussion on a learning forum through Internet devices.
- (d) I would like to be able to interact with teachers and classmates both inside and outside class via internet devices.

- (e) I would like to be able to engage in class discussion if I could share my thoughts in real-time through mobile devices.
- (f) It would not require me a lot of mental effort to learn because I am skilled at mobile devices functions.
- (g) It would be easy and clear to interact via mobile devices for learning.
- (h) It would be easier for me to ask help from others through mobile devices.

Responses were given on a 4-point Likert scale ranging from strongly disagrees to agree. The correlation statistics for effort expectancy from which the following results were obtained is found under the list of tables.

A correlation analysis was conducted to determine the level of relationship between the usefulness of Internet for learning when used everywhere, and the respondents' willingness to interact with teachers and classmates both inside and outside class via internet devices. There was a large positive relationship found [$r(116) = +0.988, p < 0.05$] between the usefulness of Internet for learning when used everywhere, and the respondents' willingness to interact with teachers and classmates both inside and outside class via internet devices.

A correlation analysis was conducted to determine the strength of association between the mobility, which enables the respondents to access real-time data, and less mental effort it would require the respondents to learn because of respondents' skill at mobile devices' functions. There was a large positive correlation found [$r(116) = +0.929, p < 0.05$] between the mobility which enables the respondents to access real-time data, and less mental effort it would require the respondents to learn because of respondents' skill at mobile devices' functions.

Pearson correlation analysis was conducted to determine the level of association that exists between the respondents' willingness to be able to launch a discussion on a learning forum through Internet devices, and the use of Internet for learning which would be everywhere and useful. The results portrayed a large positive correlation [$r(116) = +0.953, p < 0.05$] between the respondents' willingness to be able to launch

a discussion in a learning forum through Internet devices, and the use of Internet for learning which would be everywhere and useful.

Pearson correlation analysis was conducted to determine the level of association that exists between the respondents' willingness to be able to engage in class discussions if they could share their thoughts in real-time through mobile devices, and willingness to interact with teachers and classmates both inside and outside class via internet devices. The study found a large positive correlation, [$r(116) = +0.973, p < 0.05$] between the respondents' willingness to be able to engage in class discussions if they could share their thoughts in real-time through mobile devices, and willingness to interact with teachers and classmates both inside and outside class via internet devices.

A correlation analysis was conducted to examine the strength of association between the respondents' willingness to be able to engage in class discussions if they could share their thoughts in real-time using mobile devices, and less mental effort required to learn because of respondents' skill at mobile devices' functions. A moderate positive correlation was found [$r(116) = +0.468, p < 0.05$] between the learners' encouragement to learn if they could access materials anytime and anywhere via mobile devices, and the use of Internet for learning purposes in enhancing the effectiveness of their learning.

A correlation analysis was conducted to examine the strength and direction of correlation between the ease for respondents to ask for help from others through mobile devices, and the respondents' willingness to be able to launch a discussion on a learning forum through Internet devices. A large positive correlation was found [$r(116) = +0.930, p < 0.05$] between the ease for respondents to ask for help from others through mobile devices, and the respondents' willingness to be able to launch a discussion on a learning forum through Internet devices.

Table 9: *Cronbach's Reliability Statistics for Effort Expectancy*

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
0.878	0.965	8

In Table 9, the alpha value of this size, ($\alpha = 0.878$) indicates that the sub variables asked in the questionnaire relating to effort expectancy are reliable and consistent. Apart from that, the results obtained are positive and meet the requirements and the assumptions of the model.

5.2.2.1 Linear Regression assumptions and correction of violations

(a) Linearity

In the lack of fit test, the probability of the F test statistic ($F = 0.722$) was $p = 0.757$, greater than the alpha level of significance of 0.05. The alternative hypothesis that "a linear regression model is appropriate" was not rejected. The null hypothesis that "a linear regression model is not appropriate" was not supported by this test. The assumption of linearity was met.

(b) Independence

The Durbin-Watson statistic for this problem is 2.10, which falls within the acceptable range from 1.50 to 2.50. The analysis satisfied the assumption of independence of errors.

(c) Normality

When evaluating normality for effort expectancy, this study used the skewness statistics to check if values obtained were both within the range of acceptable values from -1.0 to +1.0. The values obtained met this assumption of normality.

The alternative hypothesis that "the distribution of the residuals is normally distributed" was not rejected. The null hypothesis that "the distribution of the residuals is not normally distributed" was not supported.

(d) Homogeneity

The largest sample standard deviation (4.12118) divided by the smallest sample standard deviation (1.07315) is greater than two (3.84). Therefore, the assumption that the population variances are equal has not been met. Even though this assumption was violated, the researcher would not do a transformation since it could impact the relationships of the other independent variables with the dependent variable (Statistics Solutions, 2013).

Effort expectancy met the three main assumptions of linear regression as explained under linearity, independence, and normality. The violation of homogeneity did not jeopardise the results of the study, but effort expectancy was found to be less influential (when compared to performance expectancy) on the learners' intention to adopt and use Cloud computing (*cf.* section 5.2.2 and 5.3.2).

Research Question # 3

5.2.3 How much of the determinants explain the usage of Cloud computing?

To address this question, the standardised beta coefficient from multiple linear regression model was used to determine how much of the determinants explain the usage of Cloud computing. The determinants under question here were performance expectancy, effort expectancy, social influence, and facilitating conditions. The Beta coefficient tables for all these constructs are available under the list of tables. The linear regression assumptions for performance expectancy and effort expectancy below have been tested already (*cf.* section 5.2.1 and 5.2.2).

5.2.3.1 Performance expectancy

The Y intercept of the raw score model was labelled as the constant and had a value of 2.117. Of primary interest, here are the raw Beta (β) and standardized Beta coefficients, and their significance levels determined by t tests. With no exception, all of the sub variables were statistically insignificant.

5.2.3.2 Effort expectancy

In Table 10, the Y intercept of the raw score model was labelled as the constant and had a value of $\beta = 2.115$. All of the sub variables for effort expectancy were statistically insignificant with p values greater than the significance level of $p < 0.05$. As can be seen in Table 10, by examining the beta weights, 'it would be easier for me to ask help from others through mobile devices' followed by, 'Internet use for learning would be everywhere and useful' made relatively smaller contributions to the prediction model.

Table 10: *Beta Coefficients for effort expectancy*

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.115	.211		10.021	.000
	Internet use for learning would be everywhere and useful.	.186	.535	.242	.348	.728
	Mobility enables me to access real-time data.	.212	.340	.217	.625	.533
	I would like to be able to launch a discussion on a learning forum	-.226	.334	-.292	-.677	.500

through Internet devices.					
I would like to be able to interact with teachers and classmates both inside and outside class via internet devices.	-.358	.594	-.455	-.602	.548
I would like to be able to engage in class discussion if I could share my thoughts in real-time through mobile devices.	.394	.387	.502	1.018	.311
It would not require me a lot of mental effort to learn because I am skilled at mobile devices functions.	-.276	.219	-.339	-1.263	.209
It would be easy and clear to interact via mobile devices for learning.	-.012	.028	-.048	-.446	.657
It would be easier for me to ask help from others through mobile devices.	.008	.205	.012	.041	.968

5.2.3.3 Social influence

The Y intercept of the raw score model was labelled as the constant and had a value of $\beta = 1.438$. The independent variable for social influence was statistically insignificant with $\beta = 0.066$, $t = 0.704$, $p = 0.483$.

5.2.3.3.1 Linear Regression assumptions and correction of violations

(a) Linearity

In the lack of fit test, the probability of the F test statistic ($F = 1.965$) was $p = 0.164$, greater than the alpha level of significance of 0.05. The alternative hypothesis that "a linear regression model is appropriate" was not rejected. The null hypothesis that "a linear regression model is not appropriate" was not supported by this test. This means that the assumption of linearity was met.

(b) Independence

The Durbin-Watson statistic for this problem is 2.01, which falls within the acceptable range from 1.50 to 2.50. The analysis satisfied the assumption of independence of errors.

(c) Normality

In evaluating normality for social influence, this study used the skewness statistics to check if values obtained were both not within the range of acceptable values from -1.0 to +1.0. The values obtained did not meet this assumption of normality.

The alternative hypothesis that "the distribution of the residuals is normally distributed" was rejected. The null hypothesis that "the distribution of the residuals is not normally distributed" was supported.

(d) Homogeneity

The largest sample standard deviation divided by the smallest sample standard deviation is not greater than two, but (1.0). Therefore, the assumption that the population variances are equal was met.

5.2.3.4 Facilitating conditions

The unstandardised constant had a value of $\beta = 1.978$. The independent variable for facilitating conditions had no significance towards Cloud computing adoption and use with $\beta = -0.092$, $t = -0.985$, $p = 0.327$.

5.2.3.4.1 Linear Regression assumptions and correction of violations

(a) Linearity

In the lack of fit test the probability of the F test statistic ($F = 0.280$) was $p = 0.840$, greater than the alpha level of significance of 0.05. The alternative hypothesis that "a linear regression model is appropriate" was not rejected. The null hypothesis that "a linear regression model is not appropriate" was not supported by this test. This means that the assumption of linearity was met.

(b) Independence

The Durbin-Watson statistic for this problem is 2.06, which falls within the acceptable range from 1.50 to 2.50. The analysis satisfied the assumption of independence of errors.

(c) Normality

In evaluating normality for social influence, this study used the skewness statistics to check if values obtained were both not within the range of acceptable values from -1.0 to +1.0. The values obtained did not meet this assumption of normality.

The alternative hypothesis that "the distribution of the residuals is normally distributed" was rejected. The null hypothesis that "the distribution of the residuals is not normally distributed" was supported.

(d) Homogeneity

The largest sample standard deviation divided by the smallest sample standard deviation is not greater than two (1.0). Then, the assumption that the population variances are equal has been met.

For both social influence and facilitating conditions, the assumption of normality was not met, and this negative effect of social influence on behavioural intention is discussed (*cf.* section 5.2.3). The null hypothesis which stated that social influence plays a positive role on the learners' adoption and use of Cloud computing was not rejected (*cf.* section 5.3.3).

Research Question # 4

5.2.4 Which is (are) the best predictor of Cloud computing usage given a set of determinants?

To address this question, a multiple linear regression analysis was performed to determine the best predictors of Cloud computing usage given a set of determinants (performance expectancy, effort expectancy, social influence, and facilitating conditions). The construct tied to usefulness, namely performance expectancy, has consistently been shown to be the strongest predictor of behavioural intention (Venkatesh *et al.*, 2003). Among the four main constructs assessed, performance expectancy was the strongest determinant of Cloud computing adoption and application.

There are 115 ($N - 1$) total degrees of freedom. With 10 predictors (To use Internet for learning purposes would save me a lot of time. To use Internet for learning purposes would enhance the effectiveness of my learning. Mobility enables me to accomplish tasks quickly. Mobile devices are also mediums for learning. Unexpected problems could be fixed at the first time of using internet devices. I would feel more interested to study if I could use Internet devices. I would be entertained in my study by using Internet devices. It would ease my learning because it allows me to study anytime, anywhere. I would be more encouraged to learn if I could access materials anytime anywhere via mobile devices. It would be more desirable to use mobile devices as a way for learning), the Regression effect had 10 degrees of freedom. The Regression effect is statistically insignificant indicating that prediction of the dependent variable is not accomplished better than can be done by chance. However, when a correlation analysis was conducted to examine the strength of association among the ten sub variables, a large positive correlation was found between all the dependant variables. All the sub variables were significant at the level of $p < 0.05$.

The regression analysis for performance expectancy provides an overview of the results (*cf.* list of tables). Of primary interest are the R Square and Adjusted R Square values, which are 0.074 and -0.015, respectively. The weighted combination of the predictor variables explained approximately 1% of the variance of behavioural intention. The loss of so much strength in computing the Adjusted R Square value is primarily due to a relatively small sample size combined with a relatively large set of predictors. Using the standard regression procedure where all of the predictors were entered simultaneously into the model, R Square Change went from zero before the model was fitted to the data to 0.074 when the variable was entered.

The Zero-order column under the correlations listed the Pearson r values of the dependent variable (intention to use Cloud computing) with each of the predictors. The Partial column under the correlations lists the partial correlations for each predictor as it was evaluated for its weighting in the model (the correlation between the predictor and the dependent variable when other predictors are treated as covariates). The Part column under the correlations lists the semi partial correlations for each predictor once the model is finalised; squaring these values informs us of the percentage of variance each predictor uniquely explains. For example, to use Internet for learning purposes in enhancing the effectiveness of learning accounts uniquely for about 2% of the variance of behavioural intention ($-0.121 * -0.121 = 0.0146$ or approximately 0.02) given the other variables in the model.

The raw regression coefficients are *partial regression coefficients* because their values take into account the other predictor variables in the model; they inform us of the predicted change in the dependent variable for every unit increase in that predictor. For example, PE2 is associated with a partial regression coefficient of 0.933 and signifies that for every additional point on the PE2 measure, one would predict a gain of 0.933 points on the intention to continue using mobile Internet in the future measure. As another example, PE9 is associated with a partial regression coefficient of -0.504 and signifies that for every additional point on the PE9 measure,

the researcher would predict a decrease of 0.504 points on the intention to use Cloud computing measure.

The linear regression assumptions met for this predictor (performance expectancy) were discussed in section 5.2.1.1. Since there were no violations of the linear regression assumptions, performance expectancy was found to be the best predictors of Cloud computing (*cf.* section 5.2.1 and 5.3.1).

Research Question # 5

5.2.5 What is the effect of confounding variables on Cloud computing adoption and usage?

The current study has conceptualised learners' demographics, Internet self-efficacy, and experience as confounding variables that might negatively influence the findings of this study. The SPSS software has helped the researcher to analyse the effect of confounding variables on the learners' intention to adopt and use Cloud computing). The use of one-way analysis of variance ANOVA assisted in comparing the differences among means. This technique was statistically more powerful because it decreased the probability of Type I error compared to analysis of covariance (ANCOVA).

A one-way analysis of variance between groups was conducted to determine the effect that gender has on the intention to continue using mobile Internet in the future. There was a significant influence of gender at the $p < 0.05$ level, on the intention to continue using mobile Internet in the future [$F(2, 113) = 3.173, p = 0.046$].

A one-way analysis of variance was conducted to determine the level of influence that age has on the intention to continue using mobile Internet in the future. There was an insignificant influence of age at the level of $p < 0.05$, on the intention to continue using mobile Internet in the future [$F(2, 113) = 2.122, p = 0.125$].

Table 11: ANOVA for learners' demographics

		Sum of Squares	df	Mean Square	F	Sig.
Gender	Between Groups	1.496	2	.748	3.173	.046
	Within Groups	26.642	113	.236		
	Total	28.138	115			
Age of Respondents	Between Groups	2.425	2	1.212	2.122	.125
	Within Groups	64.566	113	.571		
	Total	66.991	115			

On the other hand, the reliability statistics by Cronbachs' alpha is 0.432 and unacceptable. The easiest method to find them is to compute the correlation of each test item with the total score test; items with low correlations (approaching zero) are deleted. On the other hand, if alpha is too high it may suggest that some items are redundant as they are testing the same question but in a different appearance (Mohsen, and Reg, 2011).

Table 12: Reliability Statistics for learners' Demographics

Cronbach's Alpha ^a	No. of Items
0.432	5

5.2.5.1 Linear Regression assumptions and correction of violations

(a) Linearity

In the lack of fit test, the probability of the F test statistic ($F = 0.369$) was $p = 0.830$, greater than the alpha level of significance of 0.05. The alternative hypothesis that "a linear regression model is appropriate" was not rejected. The null hypothesis that "a

linear regression model is not appropriate" was not supported by this test. This means that the assumption of linearity was met.

(b) Independence

The Durbin-Watson statistics for this problem is 2.03, which fall within the acceptable range from 1.50 to 2.50. The analysis satisfied the assumption of independence of errors.

(c) Normality

The skewness for age fell within the required range of -1.0 and +1.0 (in this case it is 0.388). On the other hand the skewness for gender also fell within the required range of -1.0 and +1.0. Hence the conclusion, that the distribution is significantly normal, and significantly negatively skewed. The alternative hypothesis that "the distribution of the residuals is normally distributed" was not rejected. The null hypothesis that "the distribution of the residuals is not normally distributed" was not supported.

(d) Homogeneity

The largest sample standard deviation (0.76324) divided by the smallest sample standard deviation (0.49465) is not greater than two (1.54). Then, the assumption that the population variances are equal has been met.

5.2.5.2 Internet self-efficacy

Internet self-efficacy refers to what individuals believe they can do with technology skills they have already acquired (Venkatesh *et al.*, 2003). Out of fifteen sub variables asked, the following seven items had a significant influence on the intention

to adopt and use Cloud computing. This justifies the inclusion of Internet self-efficacy as a confounding variable.

A one-way analysis of variance (ANOVA) between groups was conducted to compare the effect of setting a reminder or alarm for a coming event on Cloud computing adoption and use. There was a significant influence of setting a reminder or alarm for a coming event at the $p < 0.05$ level, on Cloud computing adoption and use [$F(4, 111) = 4.991, p = 0.001$].

A one-way analysis of variance was calculated to determine the extent to which using internet to translate a foreign language influences Cloud computing adoption and use. There was a significant influence of using internet to translate a foreign language at the $p < 0.05$ level, on Cloud computing adoption and use [$F(4, 111) = 4.161, p = 0.004$].

A one-way ANOVA between groups was conducted to determine the effect size of using Internet to access a social network site on Cloud computing adoption and use. There was a significant influence of using Internet to access a social network site at the $p < 0.05$ level, on Cloud computing adoption and use [$F(4, 111) = 2.785, p = 0.030$].

A one-way analysis of variance between groups was conducted to determine the effect on Cloud computing adoption and use. There was a significant influence of using Internet to remotely control personal computer at the $p < 0.05$ level, on Cloud computing adoption and use [$F(4, 111) = 3.081, p = 0.019$].

A one-way analysis of variance (ANOVA) between groups was conducted to compare the effect of using internet to subscribe to some services by sending messages on Cloud computing adoption and use. There was a significant influence of the use of internet to subscribe to some services by sending messages at the $p < 0.05$ level, on Cloud computing adoption and use [$F(4, 111) = 3.026, p = 0.021$].

A one-way analysis of variance between groups was conducted to determine the effect that the use of Internet to search needed information has on Cloud computing adoption and use. There was a significant influence of the use of Internet to search needed information at the $p < 0.05$ level, on Cloud computing adoption and use [$F(4, 111) = 2.919, p = 0.024$].

A one-way analysis of variance was conducted to determine the level of influence that the use of internet to play games has on Cloud computing adoption and use. There was a significant influence of the use of internet to play games at the $p < 0.05$ level, on Cloud computing adoption and use [$F(4, 111) = 3.768, p = 0.007$].

Table 13: *One way ANOVA for Internet Self-Efficacy*

		Sum of Squares	df	Mean Square	F	Sig.
ISE1	Between Groups	1.141	4	.285	.971	.427
	Within Groups	32.609	111	.294		
	Total	33.750	115			
ISE2	Between Groups	.631	4	.158	.458	.766
	Within Groups	38.197	111	.344		
	Total	38.828	115			
ISE3	Between Groups	.090	4	.023	.340	.850
	Within Groups	7.358	111	.066		
	Total	7.448	115			
ISE4	Between Groups	.711	4	.178	.407	.803
	Within Groups	48.461	111	.437		
	Total	49.172	115			
ISE5	Between Groups	.710	4	.177	1.194	.318

	Within	16.497	111	.149		
	Groups					
	Total	17.207	115			
ISE6	Between	.525	4	.131	.654	.625
	Groups					
	Within	22.260	111	.201		
	Groups					
	Total	22.784	115			
ISE7	Between	2.711	4	.678	1.907	.114
	Groups					
	Within	39.461	111	.356		
	Groups					
	Total	42.172	115			
ISE8	Between	6.669	4	1.667	4.991	.001
	Groups					
	Within	37.081	111	.334		
	Groups					
	Total	43.750	115			
ISE9	Between	7.144	4	1.786	4.161	.004
	Groups					
	Within	47.640	111	.429		
	Groups					
	Total	54.784	115			
ISE10	Between	2.168	4	.542	2.278	.065
	Groups					
	Within	26.410	111	.238		
	Groups					
	Total	28.578	115			
ISE11	Between	2.185	4	.546	2.785	.030
	Groups					
	Within	21.772	111	.196		
	Groups					
	Total	23.957	115			
ISE12	Between	6.447	4	1.612	3.081	.019
	Groups					
	Within	58.062	111	.523		
	Groups					
	Total	64.509	115			
ISE13	<u>Between</u>	<u>4.905</u>	<u>4</u>	1.226	<u>3.026</u>	.021

ISE14	Groups					
	Within	44.983	111	.405		
	Groups					
	Total	49.888	115			
ISE15	Between	1.139	4	.285	2.919	.024
	Groups					
	Within	10.827	111	.098		
	Groups					
ISE15	Total	11.966	115			
	Between	2.527	4	.632	3.768	.007
	Groups					
	Within	18.611	111	.168		
	Groups					
	Total	21.138	115			

2

The Cronbach's Alpha in Table 14 is also an indication that, the sub variables that were used in the questionnaire to determine the level of Internet self-efficacy among the respondents, was reliable and consistent for the sample.

Table 14: *Cronbach's Reliability Statistics for Internet Self-Efficacy*

Cronbach's Alpha	No. of Item
.857	15

5.2.5.2.1 Linear Regression assumptions and the correction of violations

(a) Linearity

In the lack of fit test, the probability of the F test statistic ($F = 1.395$) was $p = 0.230$, greater than the alpha level of significance of 0.05. The alternative hypothesis that "a

² ISE1 = I am able to use Internet services skillfully to check internet news. ISE2 = For e-booking and e-shopping. ISE3 = To download applications. ISE4 = To download interesting podcasts. ISE5 = To watch videos and listen to music. ISE6 = To process pictures. ISE7 = To deal with calculations. ISE8 = To set a reminder or alarm for a coming event. ISE9 = To translate a foreign language. ISE10 = To send messages and emails. ISE11 = To access a social network site. ISE12 = To remotely control personal computer. ISE13 = To subscribe to some services by sending messages. ISE14 = To search needed information. ISE15 = To play games.

linear regression model is appropriate" was not rejected. The null hypothesis that "a linear regression model is not appropriate" was not supported by this test. This means that the assumption of linearity was met.

(b) Independence

The Durbin-Watson statistic for this problem is 2.14, which fell within the range of 1.50 to 2.50. The analysis satisfied the assumption of independence of errors.

(c) Normality

Ten out of fifteen sub variables for Internet self-efficacy fall within the required range of (-1.0 and +1.0) in order to meet the assumption of normality (skewness). Hence, the conclusion that, the distribution is significantly normal, with some values negatively skewed and some positively skewed. All the items under the following ISE1, ISE4, ISE6, ISE7, ISE8, ISE9, ISE10, ISE11, ISE13, and ISE14 meet the assumption of normality for the distribution of skewness, except for ISE2, ISE3, and ISE5. To correct this violation of the assumption of normality, the three sub variables were removed from the analysis.

The alternative hypothesis that "the distribution of the residuals is normally distributed" was not rejected.

The null hypothesis that "the distribution of the residuals is not normally distributed" was not supported.

(d) Homogeneity

The largest sample standard deviation (0.74896) divided by the smallest sample standard deviation (0.32256) is greater than two (2.32). Then, the assumption that the population variances are equal has not been met.

5.2.5.3 Internet Experience

The following descriptive statistics and correlation table will confirm or dismiss any theory about experience as a confounding variable.

Reading from the results in Table 15, all the thirteen sub variables for experience were above the $p < 0.05$ level and as such they did not have a significant influence on the intention to use Cloud computing in the future. For IE4 the insignificance was very high at $p = 0.661$ level and this is far apart from 0.05. IE12 was moderately insignificant at 0.171 towards the intention to use mobile Internet devices in the future. For learners who may have been exposed to persistent use of Internet devices, the significance levels in Table 15 would be different.

Table 15: *One way ANOVA for Internet Experience*

		Sum of Squares	df	Mean Square	F	Sig.
(IEx1) I have used Internet devices for library	Between Groups	.707	4	.177	.790	.534
	Within Groups	24.844	111	.224		
	Total	25.552	115			
(IEx2) Downloaded school documents	Between Groups	1.538	4	.385	1.554	.192
	Within Groups	27.462	111	.247		

	Total	29.000	115			
(IEx3) Downloaded an application to learn new knowledge	Between Groups	.943	4	.236	.993	.415
	Within Groups	26.367	111	.238		
	Total	27.310	115			
(IEx4) Used Internet to search for knowledge in class	Between Groups	.617	4	.154	.604	.661
	Within Groups	28.374	111	.256		
	Total	28.991	115			
(IEx5) Used social network for discussion	Between Groups	.918	4	.230	.957	.434
	Within Groups	26.625	111	.240		
	Total	27.543	115			
(IEx6) I communicated with teachers through Internet	Between Groups	.973	4	.243	1.368	.250
	Within Groups	19.742	111	.178		
	Total	20.716	115			
(IEx7) Set a reminder on mobile device for a deadline	Between Groups	.973	4	.243	.982	.420
	Within Groups	27.476	111	.248		
	Total	28.448	115			
(IEx8) Used Internet to communicate with classmates	Between Groups	.918	4	.229	.917	.457
	Within Groups	27.772	111	.250		
	Total	28.690	115			
(IEx9) Checked study information via email or SMS	Between Groups	1.227	4	.307	1.363	.251
	Within Groups	24.980	111	.225		
	Total	26.207	115			
(IEx10) Recorded information during class	Between Groups	.618	4	.155	.793	.532
	Within Groups	21.623	111	.195		

	Groups					
	Total	22.241	115			
(IEx11) Written notes on a mobile device in class	Between Groups	1.135	4	.284	1.459	.220
	Within Groups	21.581	111	.194		
	Total	22.716	115			
(IEx12) Read an article or assignment from the Internet	Between Groups	1.531	4	.383	1.634	.171
	Within Groups	26.012	111	.234		
	Total	27.543	115			
(IEx13) Played an educational game on the Internet	Between Groups	.637	4	.159	.625	.645
	Within Groups	28.285	111	.255		
	Total	28.922	115			

The reliability statistics by Cronbachs' Alpha is 0.834. The Alpha value of this magnitude is good due to a positive average covariance among items and it corresponds with reliability model assumptions.

Table 16: *Reliability Statistics for items on Experience*

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
0.834	0.834	13

5.2.5.3.1 Linear Regression assumptions and the correction of violations

(a) Linearity

In the lack of fit test (*cf.* list of tables), the probability of the F test statistic ($F = 0.913$) was $p = 0.632$, greater than the alpha level of significance of 0.05. The alternative

hypothesis that "a linear regression model is appropriate" was not rejected. The null hypothesis that "a linear regression model is not appropriate" was not supported by this test. This means that the assumption of linearity was met.

(b) Independence

The Durbin-Watson statistic for this problem is 2.13, which falls within the acceptable range from 1.50 to 2.50. The analysis satisfied the assumption of independence of errors.

(c) Normality

Ten out of thirteen sub variables for experience fell within the required range of (-1.0 and +1.0) in order to meet the assumption of normality (skewness). Hence, the conclusion that the distribution is significantly normal, with some values negatively skewed and some positively skewed. The three variables that did not fit in the model were removed because they were redundant.

The alternative hypothesis that "the distribution of the residuals is normally distributed" was not rejected.

The null hypothesis that "the distribution of the residuals is not normally distributed" was not supported.

(d) Homogeneity

The largest sample standard deviation (0.50217) divided by the smallest sample standard deviation (0.42442) is not greater than two (1.18). Then, the assumption that the population variances are equal has been met.

Reading from the three assumptions of linear regression, that were met for Internet self-efficacy and gender (as a demographic factor), the ANOVA results displayed significant values of $p < 0.05$. Internet self-efficacy and gender qualified to be confounding variables that affect the learners' behavioural intention. Experience and age did not have a noticeable effect on behavioural intention.

Research Question # 6

5.2.6 Which model can be designed based on the best predictor(s) of Cloud computing adoption and usage for secondary school learners?

5.2.6.1 The Adoption and Application of Technology for Learning model

The Technology Acceptance Model, Model of PC Utilisation, and Motivational Model inspired the AATL model.

5.2.6.1.1 Perceptions about Internet use

Featherman and Pavlou (2003) studied the end user's cognitive and affective reaction to the potential risks often perceived inherent in using computerised services. The authors claim that perceived risk is a prominent barrier to consumer acceptance of e-services. By adding measures of negative utility (perceived usage risks) to the already existing positive utility oriented adoption model, Featherman and Pavlou (2003) seek to gain increased understanding of consumer perception helping practitioners in developing risk-reducing strategies to encourage service adoption. Perceived risk may create different emotional and cognitive reactions caused by the evaluation of costs and benefits, or risks and utility, creating dissonance (Featherman and Pavlou, 2003). Learners' perceptions about the ease of use and the enjoyment derived from using internet devices were investigated in this study using ANOVA.

5.2.6.1.2 Persistent use of Internet

This study also discovered that persistent use of Internet devices (which later on translates to experience) facilitates the constructs to use behaviour (*cf.* Chapter 5, section 5.2.5.3). Contrary to the belief held Lenhart *et al.* (2010), the current study did not find experience to be a mediating factor towards behavioural intention instead persistent use was found to affect behavioural intention.

5.2.6.1.3 Price of Internet

Through conducting a one way ANOVA, the three independent variables for price were found to directly influence the intention to adopt and use Cloud computing (*cf.* Table 21 under the list of tables).

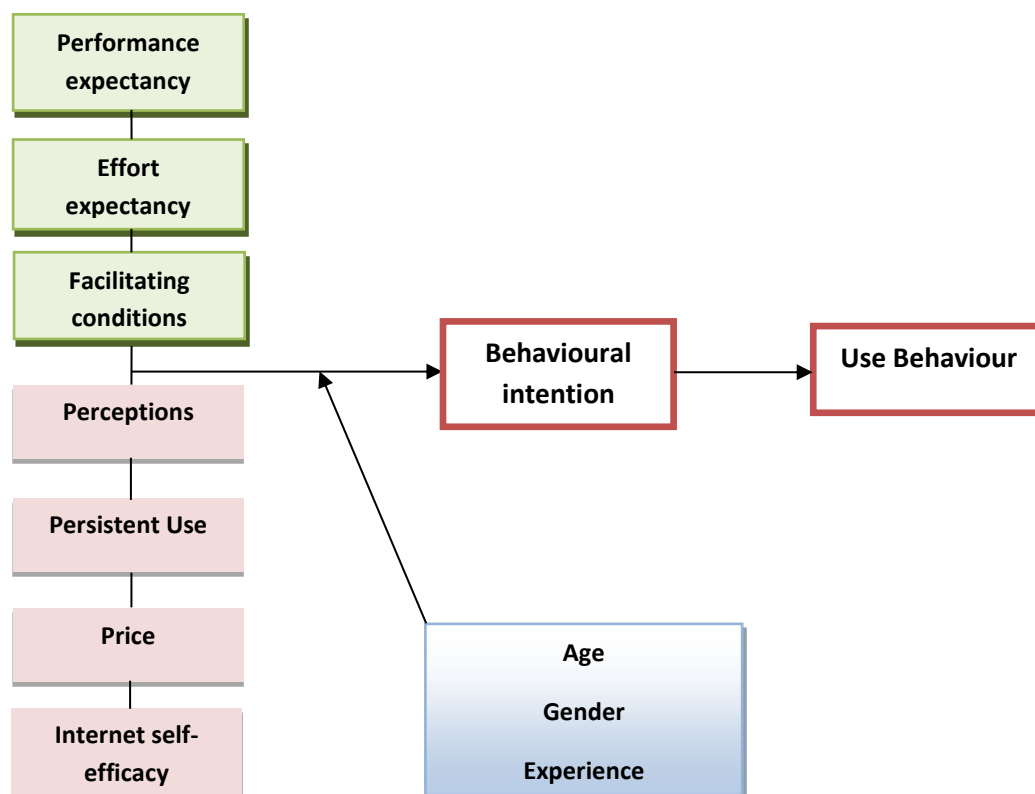


Figure 6: The researcher's proposed AATL model

The constructs that the researcher adapted to the model are the four pink blocks in Figure 6 (perceptions about Internet use, persistent use, price of Internet and internet self-efficacy). Internet self-efficacy was added to the AATL model based on the results that internet self-efficacy was found not to be a confounding variable but a variable that directly affects behavioural intention (*cf.* Chapter 5, Section 5.2.5.2). The proposed model brings a new contextual perspective to the original UTAUT model. As depicted in Figure 6, the price of Internet access is theorised to have a direct effect on the use of Internet services.

Another modification observed in Figure 6 is that, voluntariness has been dropped as a moderating factor. While in general, voluntariness can be perceived as a range from mandatory to voluntary, learners have no educational obligation and thus, most learner behaviours are voluntary, resulting in no variance in the voluntariness construct (Venkatesh *et al.*, 2003). This is the reason why the researcher did not include voluntariness as a relevant construct for the model. This has only affected one relationship (*i.e.*, the social influence–behavioural intention relationship).

Furthermore, social influence from the UTAUT has not been included in the AATL model; because this study did not find it to have a positive role to play in Cloud computing adoption and application (*cf.* Chapter 5, section 5.2.3.3). Moreover, the insignificant role of social influence is understandable, especially when the facilitating conditions (infrastructure not available) are significant to an extent that they overshadow social influence.

When a one way ANOVA was conducted to compare the level of influence that learners' demographics (age and gender) have on behavioural intention, age did not have a significant influence, instead gender was found to be significant in influencing learners to adopt and use the Cloud (*cf.* Chapter 5, section 5.2.5). This finding facilitated the researcher's inclusion of gender as a confounding variable in Figure 6. It has been noted that the gender differences on behavioural intention could be driven by cognitions related to gender roles and this study confirmed this influence of

age (Lynott & McCandless, 2000). Increased age has been shown to be associated with difficulty in processing complex stimuli and allocating attention to information when using technology (Plude & Hoyer, 1985), both of which may be necessary when using software systems. Since the age group in this study was almost the same, age was not found to have a significant influence on behavioural intention.

The last breakthrough found was the ability of this study to prove that Internet self-efficacy has a potential to influence Cloud computing usage, and hence its inclusion in the AATL model (*cf.* Chapter 5, section 5.2.5.2). Out of fifteen variables loaded for analysis, the cleaning of irrelevant and redundant data was performed and seven variables had a positive influence on the learners' behavioural intention.

The AATL model designed by the researcher is open to further scrutiny in contexts similar to where the current study was undertaken. The advantage of the AATL model is that, it borrowed from tried and tested technology acceptance models and theories.

5.3 RESEARCH HYPOTHESES AND STATISTICAL FINDINGS

Cronbach's reliability statistics obtained for the five sections of the instrument were $\alpha = 0.857$ (Internet self-efficacy), $\alpha = 0.834$ (Experience), $\alpha = 0.987$ (Performance Expectancy), $\alpha = 0.878$ (Effort Expectancy), and $\alpha = 0.432$ (Learners' demographics). George and Mallery (2003) recommend that a Cronbach's Alpha of 0.70 or better could generally be acceptable as good reliability.

Reading from the correlations tables (*cf.* Table 7, 11, and 24) throughout the study, the (p) values show the probability that one would obtain an r that is high if the two variables were not correlated in the overall population from which the sample has been drawn. In this study, the researcher mainly used the significance level of (α) 0.05 in analysing data. Any p value that is less than this significance level indicates that the variables are probably correlated in the population from which the

researchers' sample has been drawn (Leedy and Ormrod, 2005). McHugh (2008) maintains that if the Pearson R value is below 0.30, then the relationship is weak, no matter how significant the result.

5.3.1 H_a1: Performance expectancy will affect the learners' intention to use Cloud computing

H₀1: Performance expectancy will not affect the learners' intention to use Cloud computing

A one-way analysis of variance (ANOVA) between groups was conducted to compare the effect of the respondents' use of Internet for learning purposes which would enhance the effectiveness of their learning on the intention to use Cloud computing. There was a significant influence of the respondents' use of Internet for learning purposes which would enhance the effectiveness of their learning, on the intention to use Cloud computing [$F(3, 112) = 150.697, p < 0.05$].

A one-way analysis of variance was calculated to determine the extent to which mobility which enables the respondents to accomplish tasks quickly influences the intention to use Cloud computing. There was a significant influence of mobility which enables the respondents to accomplish tasks quickly, on the intention to use Cloud computing [$F(3, 112) = 53.156, p < 0.05$].

A one-way ANOVA between groups was conducted to determine the effect size of respondents' knowledge of mobile devices as devices for learning on the intention to use Cloud computing. There was a significant influence of respondents' knowledge of mobile devices as devices for learning, on the intention to use Cloud computing [$F(3, 112) = 28.863, p < 0.05$].

A one-way analysis of variance between groups was conducted to determine the effect that fixing unexpected problems at the first time of using Internet devices has on the intention to use Cloud computing. There was a significant influence of fixing

unexpected problems at the first time of using Internet devices, on the intention to use Cloud computing [$F(3, 112) = 75.638, p < 0.05$].

A one-way analysis of variance between groups was conducted to determine the effect that using Internet devices stimulates more interest to study, has on the intention to use Cloud computing. There was a significant influence of more interest to study among learners because of using Internet devices, on the intention to use Cloud computing [$F(3, 112) = 2274.67, p < 0.05$].

A one-way analysis of variance was conducted to determine the level of influence that the respondents' feeling of being entertained in their studies when using Internet devices has on the intention to use Cloud computing. There was a significant influence of the learners' feeling of being entertained in their studies when using Internet devices, on the intention to use Cloud computing [$F(3, 112) = 149.919, p < 0.05$].

A one-way ANOVA was calculated to measure the effect of the ease of learning because of studying anytime and anywhere on the intention to use Cloud computing. There was a significant influence of the ease of learning because of studying anytime and in anyplace, on the intention to use Cloud computing [$F(3, 112) = 169.963, p < 0.05$].

A one-way analysis of variance (ANOVA) was calculated to determine the level of influence that being more encouraged to learn if they could access materials anytime anywhere via mobile devices has on the intention to use Cloud computing. A significant level of influence of being more encouraged to learn if they could access materials anytime anywhere via mobile devices, was found on the intention to use Cloud computing [$F(3, 112) = 131.825, p < 0.05$].

A one-way analysis of variance (ANOVA) was conducted to examine the effect that more desire to use mobile devices as a way for learning has on the intention to use

Cloud computing. There was a significant influence of more desire to use mobile devices as a way for learning, on the intention to use Cloud computing [$F(3, 112) = 56.859, p < 0.05$].

Table 17: *One way ANOVA for performance expectancy*

		Sum of Squares	df	Mean Square	F	Sig.
To use Internet for learning purposes would enhance the effectiveness of my learning.	Between Groups	169.818	3	56.606	150.697	.000
	Within Groups	42.070	112	.376		
	Total	211.888	115			
Mobility enables me to accomplish tasks quickly.	Between Groups	102.795	3	34.265	53.156	.000
	Within Groups	72.197	112	.645		
	Total	174.991	115			
Mobile devices are also mediums for learning.	Between Groups	74.650	3	24.883	28.863	.000
	Within Groups	96.557	112	.862		
	Total	171.207	115			
Unexpected problems could be fixed at the first time of using internet devices.	Between Groups	127.765	3	42.588	75.638	.000
	Within Groups	63.062	112	.563		
	Total	190.828	115			
I would feel more interested in study if I could use Internet devices.	Between Groups	245.522	3	81.841	2274.670	.000
	Within Groups	4.030	112	.036		
	Total	249.552	115			
I would be entertained in my study by using Internet devices.	Between Groups	172.383	3	57.461	149.919	.000
	Within Groups	42.927	112	.383		
	Total	215.310	115			
It would ease my learning because it allows me to study anytime, anyplace.	Between Groups	188.542	3	62.847	169.963	.000
	Within Groups	41.415	112	.370		
	Total	229.957	115			
I would be more encouraged to learn if I could	Between Groups	189.208	3	63.069	131.825	.000
	Within Groups	53.585	112	.478		

access materials anytime anywhere via mobile devices.	Total	242.793	115			
It would be more desirable to use mobile devices as a way for learning.	Between Groups	139.568	3	46.523	56.859	.000
	Within Groups	91.639	112	.818		
	Total	231.207	115			

The strength and direction of the statistical relationship imply that performance expectancy is closely associated with the intention to use Internet services. The data presented in Table 17 show that all the p values for performance expectancy were significant at the level of $p < 0.05$, and this is supported in all instances where ($n = 116$, $p < 0.05$).

On the basis of the ANOVA results, the study failed to reject the first alternative hypothesis that 'Performance expectancy will affect the learners' intention to use Internet services'.

5.3.2: H_{a2}: Effort expectancy will affect the learners' intention to use Cloud computing.

H₀₂: Effort expectancy will not affect the learners' intention to use Cloud computing.

A one-way analysis of variance (ANOVA) between groups was conducted to compare the effect that Internet use for learning would be everywhere and useful has on the intention to use Internet services. There was a significant influence of Internet use for learning would be everywhere and useful, on the intention to use Internet services [$F(4, 111) = 136.325$, $p < 0.05$].

A one-way analysis of variance was calculated to determine the extent to which mobility which enables learners to access real-time data influences the intention to use Internet services. There was a significant influence of mobility which enables

learners to access real-time data, on the intention to use Internet services [$F(4, 111) = 85.475, p < 0.05$].

A one-way ANOVA between groups was conducted to determine the effect size of the learners' interest of being able to launch a discussion on a learning forum through Internet devices, on the intention to use Internet services. There was a significant influence of the learners' interest of being able to launch a discussion on a learning forum through Internet devices, on the intention to use Internet services [$F(4, 111) = 209.246, p < 0.05$].

A one-way analysis of variance between groups was conducted to determine the effect that the learners' interest to be able to interact with teachers and classmates both inside and outside class via internet devices has, on the intention to use Internet services. There was a significant influence of the learners' interest to be able to interact with teachers and classmates both inside and outside class via internet devices, on the intention to use Internet services [$F(4, 111) = 122.281, p < 0.05$].

A one-way analysis of variance between groups was conducted to determine the effect that the learners' interest to be able to engage in class discussion if they could share their thoughts in real-time through mobile devices has on the intention to use Internet services. There was a significant influence of the learners' interest to be able to engage in class discussion if they could share their thoughts in real-time through mobile devices, on the intention to use Internet services [$F(4, 111) = 130.589, p < 0.05$].

A one-way analysis of variance was conducted to determine the level of influence of the belief that it would not require them a lot of mental effort to learn if they are skilled at mobile device functions on the intention to use Internet services. There was a significant influence of the belief that it would not require them a lot of mental effort to learn if they are skilled at mobile device functions, on the intention to use Internet services [$F(4, 111) = 40.405, p < 0.05$].

A one-way ANOVA was calculated to measure the effect of ease and clarity to interact through mobile devices for learning on the intention to use Internet services. There was a significant influence of ease and clarity to interact through mobile devices for learning, on the intention to use Internet services [$F(4, 111) = 4.059, p < 0.05$].

Table 18: *One way ANOVA for Effort Expectancy*

		Sum of Squares	df	Mean Square	F	Sig.
Internet use for learning would be everywhere and useful.	Between Groups	178.057	4	44.514	136.325	.000
	Within Groups	36.245	111	.327		
	Total	214.302	115			
Mobility enables me to access real-time data.	Between Groups	99.980	4	24.995	85.475	.000
	Within Groups	32.459	111	.292		
	Total	132.440	115			
I would like to be able to launch a discussion on a learning forum through Internet devices.	Between Groups	187.664	4	46.916	209.246	.000
	Within Groups	24.888	111	.224		
	Total	212.552	115			
I would like to be able to interact with teachers and classmates both inside and outside class via internet devices.	Between Groups	167.448	4	41.862	122.281	.000
	Within Groups	38.000	111	.342		
	Total	205.448	115			
I would like to be able to engage in class discussion if I could share my thoughts in real-time through mobile devices.	Between Groups	170.374	4	42.593	130.589	.000
	Within Groups	36.204	111	.326		
	Total	206.578	115			
It would not require	<u>Between</u>	113.595	<u>4</u>	28.399	<u>40.405</u>	.000

me a lot of mental effort to learn because I am skilled at mobile device functions.	Groups					
	Within	78.017	111	.703		
	Groups					
	Total	191.612	115			
It would be easy and clear to interact through mobile devices for learning.	Between	249.254	4	62.314	4.059	.004
	Groups					
	Within	1703.918	111	15.351		
	Groups					
	Total	1953.172	115			

As indicated in the results in Table 18, all the p values for effort expectancy were significant at the level of $p < 0.05$. This study failed to reject the second alternative hypothesis that “Effort expectancy will affect the learners’ intention to use Internet services”.

The alternative hypothesis was positively stated, and its acceptance means there is no way that the alternative hypothesis could be rejected as the ANOVA results show in Table 18.

5.3.3 H_a3: Social influence plays a positive role on Internet services’ adoption and use.

H₀3: Social influence does not play a positive role on Internet services’ adoption and use.

In Table 19, a one-way analysis of variance was conducted to determine the effect that social influence has on the intention to use Internet services. There was no significant influence of social influence at the $p < 0.05$ level, on the intention to use Internet services [$F(2, 113) = 1.233, p = 0.295$], [$F(2, 113) = 0.608, p = 0.546$], and [$F(2, 113) = 0.226, p = 0.798$].

Table 19: *One way ANOVA for social influence*

		Sum of Squares	df	Mean Square	F	Sig.
I intend to continue using mobile internet in the future.	Between Groups	2.716	2	1.358	1.233	.295
	Within Groups	124.491	113	1.102		
	Total	127.207	115			
I will always try to use mobile internet in my daily life.	Between Groups	2.071	2	1.035	.608	.546
	Within Groups	192.507	113	1.704		
	Total	194.578	115			
I plan to continue to use mobile internet frequently.	Between Groups	.627	2	.313	.226	.798
	Within Groups	156.408	113	1.384		
	Total	157.034	115			

The reliability statistics for Cronbachs' alpha also revealed negative results. There is no way that this hypothesis could hold. Therefore, the third alternative hypothesis that 'Social influence plays a positive role on Internet services' adoption and use' was rejected. If one concludes, 'Do not reject H_0 ', this does not necessarily mean that the null hypothesis is true; it only suggests that there is not sufficient evidence against H_{03} in favour of H_{a3} . Failing to reject the null hypothesis therefore, suggests that the sample has not strongly opposed it (Al-Shafi and Weerakkody, 2009).

5.4 CONCLUSION

This chapter presented the statistical analysis of the information received from the survey, which was undertaken to investigate the determinants of Internet services' adoption and application among learners. All the research questions have been addressed, and the following are the conclusions based on each research question and hypothesis.

Performance expectancy was found to have a positive significant influence on behavioural intention. Performance expectancy has been found to be the best predictor of Internet services' usage among other constructs. The alternative hypothesis which stated that performance expectancy will affect learners' intention to adopt and use Internet services was accepted.

Effort expectancy was found to have a positive significant influence on behavioural intention. The alternative hypothesis which stated that effort expectancy will affect learners' intention to adopt and use Internet services was accepted.

The null hypothesis, which stated that social influence does not play a positive role on Internet services' adoption and use was not rejected.

Among the theorised confounding variables (learners' demographics, Internet experience, and Internet self-efficacy), Internet self-efficacy was found to have a significant effect on Internet services' adoption and usage.

This study established the important role played by perceptions about Internet, price, and persistent use in the AATL, which is tailored to the context of learner's adoption and application of Internet services.

The next chapter discusses the findings of the literature review and the empirical study in order to draw conclusions and make recommendations and suggestions for further research.

CHAPTER 6

DISCUSSION OF FINDINGS

6.0 INTRODUCTION

This chapter discusses findings in relation to the research questions together with various theoretical frameworks. It also seeks to confirm or refute findings made by other researchers and to establish or introduce new knowledge to the public domain.

The aim of the research was to investigate the determinants of Internet services' adoption and use among high school learners, to note concerns regarding e-learning, and make recommendations as to how internet technology can be utilised to address such limitations.

The descriptive statistics and frequency tables in this study list notable concerns of high school learners with regard to Internet services' adoption and application. Most of the concerns are evidence that there is need for more pro-active and practical intervention in the schools to save the credibility of schools. These concerns were deduced from individual themes and UTAUT constructs that helped shape the following research questions and hypotheses.

Research Question # 1

6.1 What is the effect of performance expectancy on the learners' intention to adopt and use Internet services?

6.1.1 Motivation for teachers to introduce internet technology in education

In this section, the Internet is seen as a vehicle to provide a holistic education with the capability of extending beyond the classroom and the constraints of time. The

literature (*cf.* Chapter 2, section 2.3.1.6) refers to the role of the teacher in assimilating new and old technologies in a symbiotic relationship.

The enormous possibilities offered by internet technology enable teachers to publish their notes on the web and students to work independently and collectively using a host of multi-media. The literature suggests that there is an opportunity to extend the communication methods of both teacher and student via various linkages allowing for feedback, updates, information gathering, dissemination and exchange of viewpoints. All the sub variables for performance expectancy were strongly correlated with one another (*cf.* Chapter 5, section 5.2.1). Consequently, a correlation analysis was conducted to determine the level of relationship that exists between the use of Internet for learning purposes, which would save the respondents a lot of time, and their interest to study. It was found that there is a large positive relationship [$r(116) = +0.988, p < 0.05$] between the use of Internet for learning purposes which would save the respondents a lot of time, and more interest in study because of the use of Internet devices.

Table 23 (*cf.* list of tables) further confirms the report by Hutchison and Bekkering (2009) indicating the significance (for all sub variables the level of significance was = 0.000) of performance expectancy on behavioural intention of technology adoption. The descriptive statistics for performance expectancy show that the respondents strongly agreed that they would feel more interested to study if they could use Internet devices (SE = 0.13677, SD = 1.47310). Hence, the distribution of skewness for the feeling of more interest in studies if they (learners) could use Internet devices is approximately normal and is negatively skewed. Those who agreed to use Internet for learning purposes would save them a lot of time (mean = 2.6897, S = -0.162) were more likely to adopt Internet services, than those who disagreed or strongly disagreed with such a view.

The reason for the very much dwelling interest in the diffusion of innovations is that, getting a new idea adopted, even when it has obvious advantages, is very difficult

(Rogers, 2003). The main concerns of the innovation diffusion research centres on how innovations are adopted as well as the reasons behind innovations are adopted at different rates. Rogers explains diffusion as the process by which an innovation is communicated through certain mediums over a certain period among the members of a social system (Rogers, 2003). The reason for communicating new technologies for a certain period among learners would be aimed at promoting its advantages hence this study borrowed this idea from the Innovation Diffusion Theory.

The IDT posits that certain attributes of innovation as perceived by individuals, help to explain their different rates of adoption. Rogers (2003:229-258), defines these attributes as: (a) Relative advantage – “the degree to which an innovation is perceived as better than the idea it supersedes. (b) Compatibility – “the degree to which an innovation is perceived as being consistent with the existing values, past experiences and needs of potential adopters. (c) Complexity – “the degree to which an innovation is perceived as difficult to understand and use”. (d) Trialability – “the degree to which an innovation may be experimented with on a limited basis adopted more quickly than innovations that are not divisible”. (e) Observability – “the degree to which the results of an innovation are visible to others.

Authors like Baraghani (2007) note that relative advantage, compatibility and complexity are the three most used attributes in relation to adoption of innovation.

Since learning through Internet services has to be facilitated by teachers. Reference is made to the advantage of teachers moving from a previously protected environment and exposing themselves to critique and comments and sharing resources, unfettered by geographic boundaries. The importance of keeping ahead of technological advances is highlighted against the background of the advantages of networking communities being in the position to operate twenty-four hours a day. Mention is made of “cool tools” (Stefanics, 2008:16) which are able to extend the capacity of the learning experience for both the teacher and the learner.

The literature refers to a gap that needs to be bridged between students' independent achievement and facilitated achievement which in the past decade has required a shift in the role of the teachers from being a source of information to a facilitator equipped to guide students to gather information from many sources. This is supported by the view that PBL promotes higher-order thought processes, research and blending of disciplines and self-direction and responsibility and best prepares students for the real world. From the Innovation Diffusion Theory, which suggests trialability, it therefore means that, the Internet devices should be user friendly in order to be adopted more quickly than innovations that are not divisible. Through this ease of use, learners would be able to gather information within the required time from many sources as possible.

A correlation analysis was also conducted to examine the strength of association between the ease of the learners' learning associated with studying anytime and anywhere, and the entertainment in studies when Internet devices are used. A large positive relationship was found [$r(116) = +0.985, p < 0.05$] between the ease of the learners' learning associated with studying anytime and anyplace, and the entertainment in studies when Internet devices are used. A passive learner does not form part of this process since learning does not only take place during school hours, but extends beyond the classroom.

The literature also indicates that web-based programmes are adapted swiftly and can be regularly updated and most importantly allow for rapid response between student and teacher. Internet technology is seen as not being limited to time, space, place/situation and having the added capacity to instruct collectively or individually. A correlation analysis was conducted to examine the strength of association between the learners' encouragement to learn if they could access materials anytime and anywhere via mobile devices, and the use of Internet for learning purposes in enhancing the effectiveness of their learning. A large positive relationship was found [$r(116) = +0.983, p < 0.05$] between the learners' encouragement to learn if they

could access materials anytime and anywhere via mobile devices, and the use of Internet for learning purposes in enhancing the effectiveness of their learning.

The current study confirms the previous technology acceptance studies regarding the strength (high r values in Chapter 5, Table 7) of the performance expectancy construct in predicting behavioural intention (Louho, Kallioja & Oittinen, 2006; Al-Shafi & Weerakkody, 2009). These studies suggest that the adoption and application of Internet services may be enhanced by educating teachers and learners on the potential benefits of this mode of communication in improving the accessibility and dissemination of scholarly content.

Pearson correlation analysis was conducted to determine the level of association that exists between the fixing of unexpected problems at the first time of using Internet devices, and more desire to use mobile devices as a way of learning. The study found a large positive correlation [$r(116) = +0.954$, $p < 0.05$] between the fixing of unexpected problems at the first time of using Internet devices, and more desire to use mobile devices as a way of learning. This is an indication that, secondary school learners are likely to adopt Internet services only if they clearly understand the benefits of this mode over the traditional scholarly communication system.

From model 1 (*cf.* Table 20 under the list of tables), these independent variables PE1-10 contributed only 0.181 of the total variation observed on learners' behavioural intention to adopt and use Internet services. The correlation and R^2 are (0.425 and 0.181) respectively. The regression equation is significant with $p < 0.05$. The coefficient shows that PE1-10 has significant p values (0.000). Here the researcher concludes that PE1-10 has a positive influence on behavioural intention to adopt and use Internet services.

From model 2, PE 1-10 contributed 0.120 of the total variation observed on the behavioural intention to adopt and use Internet services. The correlation and R^2 are (0.346 and 0.120) individually. The regression equation is not significant with p -value

(0.153). The coefficient shows that PE is significant with p values < 0.05 , and it has a positive influence on the learners' behavioural intention to adopt and use Internet services.

From model 3, PE 1-10 contributed 0.270 of the total variation observed on the behavioural intention to adopt and use Internet services by high school learners. The correlation and the R^2 are (0.519 and 0.270) in that order. The regression equation is significant with p -value (0.000). The coefficient shows that PE1-10 is significant with p values < 0.05 . Therefore the researcher concludes that performance expectancy has a positive influence on the behavioural intention of the learners to adopt and use Internet services.

To validate the above discussion, the alternative hypothesis which states that performance expectancy influences behavioural intention to adopt and use Internet services was not rejected (*cf.* Chapter 5, section 5.3.1).

In order for Internet services to be diffused successfully, the keys are that, they must be reliable, easy to use, and compatible with today's advances. The success of any new technology at all, is solely dependent on how the users (learners) are being able to accept and use it. Without that, any technology, new or old will be useless.

Research Question # 2

6.2 What degree of variation exists for effort expectancy on learners' intention to adopt and use Internet services?

The results from previous studies found effort expectancy construct to play a role during early stages of new technology adoption (Venkatesh *et al.*, 2003; Louho, Kallioja & Oittinen, 2006). The results also confirm the observations made by Schaper and Pervan (2004) that many technology acceptance and usage studies found no significant influence of effort expectancy on behavioural intention. The current study also found results that concur with these previous findings. From model

5 (*cf.* Table 20 under the list of tables), effort expectancy (EE) 1-8 contributed 0.106 of the total variation observed on behavioural intention to accept and use ICT. The correlation is (0.326) and R^2 is (0.106). The regression equation is not significant with p value (0.229). The coefficient shows that EE1 is significant with p value (0.048), and it has positive influence on the behavioural intention to adopt and use Internet services.

Moreover, the moderating effects of gender towards effort expectancy with respect to behavioural intention of technology usage conform to the results reported by Venkatesh *et al.* (2003). The significance of less effort expectancy towards technology usage by females can be explained by less confidence and more reliance on assistance for usage of new technology by females as compared to males (Steinerova & Susol, 2007).

It was also noted from the results of the current study that male respondents are 41.7% more likely to use Internet devices in future than female respondents are (38.2%). These results suggest the need to provide more user-friendly interfaces for Internet device outlets such as school repositories to facilitate both access and easy dissemination of educational content for school learners.

Perceived ease of use (as a construct for effort expectancy) is about the degree to which a person believes that using a particular system would be free of effort (Davis, 1989). The ease of use scale developed by Davis (1989) considers ease of learning. This “ease of learning” evident in the Davis’ (1989) ease of use scale, *e.g.*, system is clear and understandable; system requires low mental effort; easy to get the system to do what one wants. Davis (1989) found that perceived ease of use was significantly correlated with current usage and future usage of computer. Naturally, inclination and approval would be based on the level of ease.

This study conducted a correlation analysis to determine the level of relationship between the usefulness of Internet for learning when used everywhere, and the respondents' willingness to interact with teachers and classmates both inside and outside class via internet devices. There was a large positive relationship found [$r(116) = +0.988, p < 0.05$] between the usefulness of Internet for learning when used everywhere, and the respondents' willingness to interact with teachers and classmates both inside and outside class via internet devices (*cf.* Chapter, section 5.2.2).

Similarly to the significance of effort expectancy reported by Davis (1989), from model 6 (*cf.* Table 20 under the list of tables) effort expectancy 1-8 contributed 0.193 of the total variation observed on behavioural intention to adopt and use Internet services. The correlation and the R^2 are (0.439 and 0.193) respectively. The regression equation is significant with p value (0.002) and the coefficient shows that EE6 is also significant with p value (0.000). Therefore, EE has positive influence on the behavioural intention of the learners to adopt and use Internet services.

Drawing from the arguments made in the context of performance expectancy, we expect gender, age, and experience to work in the same way (Levy, 1988). Thus, the authors propose that effort expectancy will be most significant for females, particularly those who are older and with relatively little experience with the system.

Research Question # 3

6.3 How much of the determinants explain the usage of Internet services?

While facilitating conditions are considered to have a direct effect on Internet services' usage only. It is also important to note that while other UTAUT based studies like Venkatesh *et al.* (2003), and Schaper and Pervan (2007) were longitudinal (Kripanont, 2006), this study was a cross-sectional survey in which the data was gathered just once over a period of time. Contrary to longitudinal studies

that determine behavioural intention and usage in different times (behavioural intention - during technology introduction, and usage during technology implementation), in this study both behavioural intention and usage of Internet services were determined concurrently. This is based on the assumption that since the school in the study had Internet connectivity, some learners from the school are likely to be already using Internet services while others are building interest in using such a scholarly communication system.

Within the context of this study, facilitating conditions include technical support in terms of infrastructure and skills provided to enable the learners' exploitation of Internet services. Facilitating conditions include objective factors in implementation contexts such as management support, training and the provision of technological support, all targeting at removing barriers of technology usage (Venkatesh *et al.*, 2003; Schaper and Pervan, 2004).

This study investigated the number, and type of Internet device that each learner had (*cf.* Chapter 5, section 5.1.2). The number of learners with no Internet devices was 11, which was comparably a very small amount, given a total sample of 116 learners. Only two respondents in this study owned an iPad and the availability of these devices to learners could bring about a big change in how they access educational information. The following figures on Internet device ownership, point to the fact that, there is a lack of infrastructure that is suitable to facilitate e-learning. With reference to the fourth construct of UTAUT (facilitating conditions), learners were in a dire need for appropriate Internet devices that will facilitate their learning, both in the classroom and outside the classroom.

Facilitating conditions have been found to impact on the actual usage but not behavioural intention (Helaiei, 2009; Suhendra, Hermana & Sugiharto, 2009; Zhou, Lu and Wang, 2010). An assessment of the availability or absence of the factors facilitating Internet services' adoption was done in relation to the existing practice of Internet usage in the study area.

From model 7 (cf. Table 20 under the list of tables) social influence (SI1) contributed 0.084 of the total variation observed on the behavioural intention to adopt and use Internet services. The correlation and the R^2 are (0.290 and 0.084) respectively. The regression equation is not significant with p value (0.214) and the coefficient shows that the independent variable SI1 is not significant. Therefore, social influence has no positive influence on behavioural intention to adopt and use Internet services.

According to Limayem *et al.* (2007) established in both cases of voice mail and email usage, that social influence is an important determinant of perceived ease of use, which in turn had an effect on perceived usefulness. Possibly, strong social pressures to use a system may result in usage itself. This is irrespective of whether individuals perceive the system as being useful or not. Thus, the subjective norm may encourage email usage. Following the crowd may have validity here.

In contrast to the above claims, the current study found the effect of social influence to be insignificant towards Internet services' adoption and use. From model 8, (cf. Table 20 under the list of tables) SI1 contributed only 0.055 of the total variation observed on behavioural intention to adopt and use Internet services. The correlation and R^2 are (0.234 and 0.055) respectively. The regression equation is not significant with p value (0.500). The coefficient shows that none of the independent variables is significant. Therefore, social influence has no positive influence on the behavioural intention to adopt and use Internet services.

In Davis' (1989) view, one motivation for many individuals to adopt an innovation is the desire to gain social status or image. Besides that, Venkatesh and Davis (2000) found that effect of subjective norm on image was significant measurement on system usage. Limayem *et al.* (2007) in their studies on Windows adoption found that post-adoption attitude is only based on instrumentality beliefs of usefulness and perceptions of image enhancement.

Nevertheless, from model 9, in the regression analysis summary, SI1 contributed 0.092 of the total variation observed in the behavioural intention to accept and use ICT. The correlation and R^2 are (0.304 and 0.092) respectively. The regression equation is not significant with p value (0.533). The coefficient shows that independent variables are significant on individual basis. Therefore the conclusion is that, SI1 has no positive influence on the learners' behavioural intention to adopt and use Internet services. This is partly the reason why this study rejected the alternative hypothesis, which states that, social influence plays a positive role on behavioural intention.

Venkatesh and Davis (2000) suggested that, in mandatory contexts social influences tend to have a direct effect on intention; in contrast, social influence in voluntary contexts operates by influencing perceptions about the technology—the mechanisms at play here are internalisation and identification. In mandatory settings, social influence appears to be important only in the early stages of individual experience with the technology, with its role eroding over time and eventually becoming insignificant with sustained usage, a pattern consistent with the observations of Venkatesh and Davis (2000).

The role of social influence in technology acceptance decisions is complex and subject to a wide range of contingent influences. Social influence has an impact on individual behaviour through three mechanisms: compliance, internalisation, and identification (Venkatesh & Davis, 2000). While the latter two relate to altering an individual's belief structure and/or causing an individual to respond to potential social status gains, the compliance mechanism causes an individual to alter his or her intention in response to the social pressure, *i.e.* the individual intends to comply with the social influence.

6.4 Which is (are) the best predictor(s) of Internet services' usage given a set of determinants?

The performance expectancy construct within each individual model is the strongest predictor of intention and remains significant at all points of measurement in both voluntary and mandatory settings consistent with previous model tests (Venkatesh & Davis, 2000). Most of the discussion concerning performance expectancy has been done in section 6.1.

The Beta (standardised regression coefficients) values were also used to measure how strongly each predictor variable influences the criterion variable. The beta was measured in units of standard deviation. For example, a beta value of 2.5 indicates that a change of one standard deviation in the predictor variable will result in a change of 2.5 standard deviations in the criterion variable (*cf.* Chapter 5, section 5.2.3). Thus, the higher the beta value the greater the impact of the predictor variable on the criterion variable.

The main important point about regression analysis, which this study employed, is that, a highly predictive variable could be left out in the cold, being sacrificed for the good of the model (Statistics Solutions, 2013). The researcher noted that, independent variables could correlate substantially with one another, more especially if there is only one predictor it would have a different beta weight. The researcher bore in mind that in simple linear regression the Pearson r is the beta weight of the predictor, yet in combination with the other predictors it is not a significant predictor in the multiple regression model. The reason is that one or more of the other variables in the analysis are accomplishing its predictive work (*ibid*). The point here is that, just because a variable receives a modest weight in the model or just because a variable is not contributing a statistically significant degree of prediction in the model, it is not a reason to presume that it is itself a poor predictor.

It is also important to note that the SPSS output does not contain the structure coefficients. These are the correlations of the predictors in the model with the overall predictor variate, and these structure coefficients help researchers interpret the dimension underlying the predictor model.

Based on the results of this study, it has been noted that performance expectancy was the strongest predictor of the intention to adopt Internet services when compared to other constructs. The Beta (standardised regression coefficients) values were used to determine the best predictor in conjunction with the R and R^2 values. The Y intercept of the raw score model was labelled as constant and had a value of 2.117 which was the highest among other independent variables (*cf.* Chapter 5, section 5.2.3.1). The implication of these results is that the majority of the learners at the school generally supported performance expectancy as a determinant of Internet services' adoption and use.

These findings therefore suggest that improving factors that affect learners' behavioural intention to adopt and use Internet services for learning purposes will ultimately increase the adoption of this mode of academic communication. The five constructs from different models that pertain to the (best predictor in this study) performance expectancy are perceived usefulness (TAM/TAM2, and C-TAM-TPM), extrinsic motivation (MM), job fit (MPCU), relative advantages (IDT), and outcome expectations (SCT).

Research Question # 5

6.5 What is the effect of confounding variables on Internet services' adoption and usage?

6.5.1 Internet Experience

Ajzen and Fishbein (2005) noted that feedback from previous experiences will influence various beliefs and, consequently, future behavioural performance. In this context, persistent use is a perceptual construct that reflects the results of prior experiences. The empirical findings about the role of routine behaviour in technology use have delineated different underlying processes by which routine influences technology use. Related to the operationalization of routine as prior use, Kim and Malhotra (2005) found that prior use was a strong predictor of future technology use hence it (experience) has been added as a confounding variable.

Given that there are detractors to the operationalization of routine as prior researchers use some work, such as that of Limayem *et al.* (2007), has embraced a survey and perception-based approach to the measurement of habit. Such an operationalization of routine has been shown to have a direct effect on technology use over and above the effect of intention and to moderate the effect of intention on technology use such that intention is less important with increasing habit (Limayem *et al.*, 2007). In this study, the researcher has adopted the above-discussed conceptual definitions of experience and routine (persistent use). The researcher has operationalised experience in keeping with prior research as the passage of time from the initial use of Internet technology. This brings our discussion to Internet self-efficacy as a factor that is brought about by experience (confidence) gained in using Internet devices.

6.5.2 Internet self-Efficacy

This research has theorised Internet self-efficacy as a confounding variable, and research question five sought to address this variable.

Detailed descriptive statistics regarding learners' ability to use Internet services skilfully, and the number of learners choosing each option, are shown in Table 36 under the list of tables. Questions that required a 'yes' or a 'no' response were asked. Out of 116 respondents, 94 selected yes to using Internet for e-booking and e-shopping, 16 selected no, and 6 learners did not respond to the statement. This could be an indication that, 94 learners are more likely to adopt and use Internet as a service for e-booking and e-shopping when available for use. On the other hand, 108 learners chose the third option (to download applications), which is the highest frequency.

Bandura's Cognitive theory (1986) explains the relationship between a person's behaviour, personal factors such as cognitive skills or attitudes, and the environment. Each can influence and be influenced by the other, or it influences one another. Through this theory, fifteen skills that learners are supposed to possess in order to be Internet savvy were asked and analysed as follows.

Out of the fifteen sub variables analysed through ANOVA (*cf.* Chapter 5, Table 13), the seven items discussed below had a significant influence on the intention to adopt and use Internet services. This explains the inclusion of Internet self-efficacy as a confounding variable.

There was a significant influence of setting a reminder or alarm for a coming event at the $p < 0.05$ level, on behavioural intention [$F(4, 111) = 4.991, p = 0.001$]. There might be better ways in which learners could use mobile devices to remind themselves about due dates for tests, assignments and important notices for

parents' meetings. This high level of significance requires teachers to introduce learners to other functions of mobile Internet technology.

There was a significant influence of using Internet to translate a foreign language at the $p < 0.05$ level, on behavioural intention [$F(4, 111) = 4.161, p = 0.004$]. The translation of difficult words from English to their mother tongue is applauded since it is part of learning a new vocabulary.

There was a significant influence of using Internet to access a social network site at the $p < 0.05$ level, on behavioural intention [$F(4, 111) = 2.785, p = 0.030$]. These results imply that social networks should be utilised by teachers when communicating some information as learners are inclined to use them almost every day.

There was a significant influence of using Internet to remotely control personal computer at the $p < 0.05$ level, on behavioural intention [$F(4, 111) = 3.081, p = 0.019$]. This means that, teachers can upload information on a particular website created to extract information, and learners could be able to access that information anywhere they feel like doing so.

There was a significant influence of the use of Internet to subscribe to some services by sending messages at the $p < 0.05$ level, on behavioural intention [$F(4, 111) = 3.026, p = 0.021$]. There are Internet sites to which learners could subscribe where they could have access to more resources that they probably do not have in their schools. This would enhance their learning and broaden their knowledge beyond the textbooks used in the classroom.

There was a significant influence of the use of Internet to search needed information at the $p < 0.05$ level, on behavioural intention [$F(4, 111) = 2.919, p = 0.024$]. This search of needed information needs to be facilitated and fast tracked by the school management so that it does not happen once and cease because it is not applied in

the learning context. For learners to access academic content from the Internet, it is important that they have the necessary skills. Wang and Su (2006) also support this view and assert that in order to benefit from the Internet, students should improve their information and computer literacy skills.

There was a significant influence of the use of Internet to play games at the $p < 0.05$ level, on behavioural intention [$F(4, 111) = 3.768, p = 0.007$]. High school learners are not immune to playing games, but this should be channelled to a positive direction where they are encouraged to play educational games that sharpen their cognitive skills.

Ten out of fifteen sub variables for Internet self-efficacy fell within the prerequisite range of (-1.0 and +1.0) in order to meet the assumption of normality (skewness). Hence, the conclusion that, the distribution is significantly normal, with some values negatively skewed and some positively skewed. Almost all the items for Internet self-efficacy met the assumption of normality for the distribution of skewness, except for ISE2, ISE3, and ISE5³. To correct this violation of the assumption of normality, these sub variables were removed from the analysis.

Social cognitive theory is a view that, individuals possess self-beliefs that enable them to exercise a measure of control over their thoughts, feelings, and actions, “What people think, believe, and feel affects how they behave” (Bandura, 1986:25). With this, Bandura presents a view of human behaviour in which the beliefs that people have about themselves are key functions in the exercise of control. In other words, if learners believe that they cannot cope with the challenge of using new technologies this belief might hamper their Internet self-efficacy. Learners ought to learn from one another so that their belief systems change for the betterment of their Internet skills. Thus, environments and social systems influence human behaviour on an enormous scale.

³ ISE2 = For e-booking and e-shopping. ISE3 = To download applications. ISE5 = To watch videos and listen to music.

This study has definitely borrowed from SCT, by seeking to determine the ability of each learner to use Internet services skilfully.

6.5.2.1 Interpreting and estimating skewness

In relation to Chapter 4, if skewness is positive, the data is positively skewed or skewed right, meaning that the right tail of the distribution is longer than the left. If skewness is negative, the data is negatively skewed or skewed left, meaning that the left tail is longer. If skewness = 0, the data is perfectly symmetrical. But a skewness of exactly zero is quite unlikely for real-world data (Brown, 2012). As stated in the researcher set a 95% confidence interval of skewness at about -0.59 to $+0.37$, more or less.

The results of this study reveal that Internet self-efficacy has a significant effect on the intention to adopt and use Internet services. After the cleaning of data, all the seven p values (*cf.* Chapter 5, Table 13) for Internet self-efficacy indicated a positive relationship among the sub variables significant at 0.05 but mostly significant at 0.01. These results contradict those reported by the UTAUT model developers (Venkatesh *et al.*, 2003) but confirm those reported by Schaper and Pervan (2007), in which the technology self-efficacy construct exhibited a higher level of significance in respect of intention to use innovations by their respondents.

According to Venkatesh *et al.* (2003), technology self-efficacy is expected to have no direct significance with regard to technology intention usage due to its effect being captured by the existence of effort expectancy. Significance of Internet self-efficacy in this study is thus attributed to the insignificance of experience towards learners' behavioural intention to adopt and use Internet services.

6.5.3 Experience

The findings from this study reveal that experience has no significant effect on the intention to adopt and use Internet services. The highest positive correlation between learners who have recorded information during class, and learners who have written notes on a mobile device during class was moderate at ($n = 116$, $r = +0.533$) towards the behavioural intention. The p values are not significant at 0.05 (*cf.* Table 42, under the list of tables). Downloading school documents and searching for knowledge in class has the highest covariance of 0.252, and communication with teachers through Internet has a covariance of 0.180. The results of this study confirm those reported by Limayem *et al.* (2007) that experience (which results from persistent use) has been shown to have a direct effect on technology use over and above the effect of intention. Experience has also been observed to moderate the effect of intention on technology use such that intention is less important with increasing persistent use.

Research Question # 6

6.6 Which model can be designed based on the best predictor(s) of Cloud computing adoption and usage for secondary school learners?

In the UTAUT, moderators are variables that influence the strength or direction of relationships between independent and dependent variables (Serenko, Turel and Yol, 2006). Moderators can potentially increase the predictive validity of models. Indeed, (Serenko *et al.*, 2006:23) cite Zhang who argues that “low explanatory powers and inconsistencies of (many) models may be explained by exclusion of important moderating variables reflecting individual differences such as age and gender”. Some scholars opted for adding or dropping some of the moderators to suit their specific research contexts while others retained the same variables as those in the original UTAUT model. An example of a study that maintained same moderators from the original UTAUT model includes the one reported by Louho, Kallioja and Oittinen (2006), while those by Kripanont (2006) as well as Schaper and Pervan

(2007) added more moderators to the original four UTAUT moderators. The proposed research model adapts three original UTAUT model moderators specifically considered important under the current study environment. It should be noted that the voluntariness moderator was not adapted in the current study because Internet or open access usage is not mandated among high school learners under study. Voluntariness is often used as a moderator, under situations where technology usage is mandatory (Venkatesh *et al.*, 2003).

The major theoretical contribution is in modifying the UTAUT for Internet services' adoption and use by learners in a secondary school context. Through that, the generalisability of the UTAUT from an organisational context to a learner context could be extended. Prior Cloud computing adoption and use, research has investigated the phenomenon in organisational contexts where performance expectancy is the main driver of employees' technology use intentions and behaviours. In this study, performance expectancy has also been found to be a critical determinant of behavioural intention in a school context. In the case of learners' adoption and use of Internet services, other drivers come to the fore. Three such drivers added to the UTAUT are price of Internet, perceptions about Internet use, and persistent use.

This indicates the belief that the learners have on the use of Internet that it would help them in their studies and at the same time entertain them. Learners get bored and lose interest in learning when the teacher is the only source of information. Hence, this study proposed Internet perceptions as one of the modifications to the UTAUT model.

Further, the researcher described how various moderating factors namely gender, age, and experience, moderate the effect of Internet perceptions on behavioural intention. Some interesting results are that the effect of perceptions about Internet use on behavioural intention is stronger for learners with less experience with a technology. Therefore, the addition of perceptions, price, and persistent use and

their interactions with UTAUT moderators are significant in expanding the scope and generalisability of UTAUT to the learner environment. The addition of the following three determinants by the researcher, are theorised to directly affect the learners' use behaviour.

6.6.1.1 Price of Internet

The price is positive when the benefits of using Cloud computing are perceived to be greater than the monetary cost, and such price has a positive impact on intention (Brown and Venkatesh (2005). As a result, the researcher added price (from the Motivational Model) as a predictor of learners' intention towards the use of Internet services to enhance learning.

A one way ANOVA was conducted to test the effect of the price of internet, perceptions about Internet use, and persistent use of Internet on use behaviour of the respondents and the following are the findings:

A significant influence of mobile Internet being reasonably priced was found at the $p < 0.05$ level, on use behaviour [$F(4, 111) = 3.366, p = 0.012$]. These results indicate that the costs of connecting to the Cloud do affect the learners' daily use of the Internet. The popularity of SMS in China is due to the low pricing of SMS relative to other types of mobile Internet applications (Chan *et al.*, 2008). As a result, Chan *et al.* (2008) argue for price value to have a significant impact on Internet services use.

There was a significant influence of mobile Internet as a good value for money at the $p < 0.05$ level, on use behaviour [$F(4, 111) = 3.511, p = 0.010$]. Learners see internet as good value for money, but the affordability issue comes in as a distractor to the benefits they could get from using the Internet.

The current price of mobile Internet in providing a good value for money had a significant influence at the $p < 0.05$ level, on use behaviour [$F(4, 111) = 5.639, p = 0.000$]. Without any doubt, the price of mobile Internet needs a second thought from the network providers so that schools are given special discounts on Internet connection.

6.6.1.2 Perceptions about Internet use

There was a significant influence of perceiving the use of Internet as fun at the $p < 0.05$ level, on use behaviour [$F(4, 111) = 7.450, p = 0.000$]. Schools need to take advantage of the fact that, learners use the Internet for fun. The high number of responses to using mobile Internet devices to play games also indicates this.

There was a significant influence of enjoyment of Internet use at the $p < 0.05$ level, on use behaviour [$F(4, 111) = 6.769, p = 0.000$]. To bridge the gap between using the Internet for enjoyment and using the Internet for learning, school activities should be geared towards both of these.

There was a significant influence of perceiving the use of Internet as very entertaining at the $p < 0.05$ level, on use behaviour [$F(4, 111) = 4.552, p = 0.002$]. These results again emphasise the importance of using the learners' perceptions as a vehicle to deliver teaching and learning that is not boring but pleasurable in order to improve school performance.

If Perceived Ease of Use minimally influences an individual's acceptance, yet significantly influences Perceived Usefulness, then the major emphasis of the TAM model looks to be Perceived Usefulness and the relationship between PEU and PU cannot be ignored (King and He, 2006). This finding is important in that if only one construct can be used, Perceived Usefulness would be the most important. In addition, it is important, when implementing a new technology to take into account an

individual's perceived ease of use when trying to influence their perceived usefulness.

6.6.1.3 Persistent use of Internet

When adopting the innovation, the user starts to experiment with the technology. The Experimentation is usually self-learning. The user tries to find out what the different applications do. Both Rogers (2003) and West *et al.* (2006) discovered that a user does not start using all features of a system in the beginning of adoption. This is called trialability as users test the system with a couple of features. After the early experimentation, the individual will face some Technical Challenges. The Technical Challenges (persistent use), include usage over time and how effective the innovation is. To test this from the IDT a one way ANOVA was conducted.

There was a significant influence of habitual use of the Internet at the $p < 0.05$ level, on use behaviour [$F(4, 111) = 4.217, p = 0.003$]. The results of this study have noted the importance of using Internet services frequently in order to gain more experience, which in turn will lead to Internet self-efficacy. A once-off exposure to Internet services will not make learners reap the benefits, which await them at the end, instead it should be a habit for learners.

There was no significant influence of addiction to using mobile Internet at the $p < 0.05$ level, on use behaviour [$F(4, 111) = 2.068, p = 0.090$]. This indicates that the learners are not yet at the required level (persistent use) of Internet use, as the results point to learners not being addicted to using mobile Internet for learning ($p = 0.090$).

There was a significant influence of determination to use mobile Internet at the $p < 0.05$ level, on use behaviour [$F(4, 111) = 2.908, p = 0.025$]. Learners perceive the

use of mobile Internet devices as beneficial to their learning and in achieving better results in their schoolwork. This willingness by learners to use mobile Internet devices is what teachers should build upon.

6.7 CONCLUSION

The study focused on the impact of UTAUT model and Cloud computing theoretical framework on high school learners. The results showed that the intention to adopt and use Internet services by learners is a function of various concepts including the understanding that educational IT is useful (performance expectancy), it is not difficult to use (effort expectancy); important people to the learners believe that, they should use Internet services for learning (social influence).

In the school where the study was conducted, performance expectancy was found to be the most influential predictor of learners' intention to adopt and use Internet services among the four constructs of UTAUT. The Cloud computing theoretical framework revealed the connection between learning and the independent variables, and use of ICT as it brings transformation to education. As the alternative hypotheses claimed, the study found that performance expectancy and effort expectancy play a positive role (no matter how small the role may be) in influencing the adoption and use of Internet services by secondary school learners. However, the role of social influence on behavioural intention to adopt and use the Cloud was found to be insignificant hence, the null hypothesis was not rejected.

CHAPTER 7

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

7.0 INTRODUCTION

This chapter includes the study summary, conclusions, and recommendations for follow-up research in the area of Internet technology in secondary schools. Recommendations identify potential training topics for teachers working in Information Systems and Technology (IST) environments, and areas for future studies. The summary reflects on the scientific contribution that this study has made in the academic field.

This quantitative study was descriptive in nature and it explored the various aspects that learners struggle with, in using Internet devices for learning. The empirical study was undertaken through a structured questionnaire to establish the determinants of Internet services' adoption and application among the high school learners. This would be useful to policy makers and authorities who are responsible for managing the implementation of e-learning in schools. The researcher maintains that the findings of this research would provide insight into the barriers, which are challenges to learners in secondary school classrooms. Such insight has value for immediate practical application in the reformulation of policy and determination of strategies appropriate for facilitating IST education.

7.1 SUMMARY

7.1.1 Summary based on research question # 1

What is the effect of performance expectancy on the learners' intention to adopt and use Internet services?

The five constructs from the different models that pertain to performance expectancy have been discussed in Chapter 3. These models are perceived usefulness (TAM/TAM2 and C-TAM-TPB), extrinsic motivation (MM), job-fit (MPCU), relative advantage (IDT), and outcome expectations (SCT). Even as these constructs evolved in the literature, some authors acknowledged their similarities. Usefulness and extrinsic motivation (Davis *et al.*, 1989). Usefulness and job-fit (Thompson *et al.*, 1991). Usefulness and relative advantage (Davis *et al.*, 1989; Moore and Benbasat, 1991; Plouffe, Hulland and Vandenbosch, 2001). Usefulness and outcome expectations (Compeau and Higgins, 1995b). Job-fit and outcome expectations (Compeau and Higgins, 1995b). This study was able to discover that performance expectancy has an effect on the learners' intention to adopt and use Internet services. However, from a theoretical point of view, there is reason to expect that the relationship between performance expectancy and intention will be moderated by *gender* and *age*.

7.1.2 Summary based on research question # 2

What degree of variation exists for effort expectancy on learners' intention to adopt and use Internet services?

Other studies have found effort expectancy to be more important in women (Morris *et al.*, 2000), and examination of a gender bias for the effort expectancy variable in this study found a significant difference between males and females. Effort-oriented constructs are expected to be more salient in the early stages of a new behaviour, when process issues represent hurdles to be overcome, and later become overshadowed by instrumentality concerns.

7.1.3 Summary based on research question # 3

How much of the determinants explain the usage of Internet services?

The standardised beta coefficient from multiple linear regression model was used to determine how much of the determinants explain the usage of Internet services. The sub variables for performance expectancy, effort expectancy, social influence, and facilitating conditions were statistically insignificant under the standardised beta coefficients, but statistically significant at $p < 0.05$ when considering the unstandardised beta coefficients.

7.1.4 Summary based on research question # 4

Which is (are) the best predictor(s) of Internet services' usage given a set of determinants?

Based on empirical evidence, the performance expectancy construct in this study is the strongest predictor of intention and remains significant at all points of measurement in a voluntary learning context, consistent with previous model tests (Agarwal and Prasad, 1998; Compeau and Higgins, 1995b; Taylor and Todd, 1995a; Thompson *et al.*, 1991). As shown from Chapter 1 to Chapter 5, the UTAUT model includes moderating variables that influence the independent variables, which in turn, influence the dependent variables of behavioural intention and use behaviour. The moderating variables are gender, age, experience, and voluntary use. The impact of these moderators has led to performance expectancy being the best predictor among other constructs. In the context of this study, age was found not having any effect on the intention to adopt and use Internet services.

7.1.5 Summary based on research question # 5

What is the effect of confounding variables (if any) on Internet services' adoption and usage?

This study was informative to the researcher as to which components of technology adoption and application are important. The two dependent constructs used in this model are behavioural intent and use behaviour. In the context of this study, the

independent variables of performance expectancy, effort expectancy, social influence, and facilitating conditions are key components of behavioural intention. As this study showed, social influence does not appear to have much contribution to behavioural intention instead Internet self-efficacy and demographic factors do. However, these factors are shown to have a different impact on different social groups and therefore should be included in an acceptance study. Social influence, sometimes referred to as social norms, was only significant to learners studying commercial subjects. In this study, it was only significant for that group with higher values explaining the variance of behavioural intention.

7.1.6 Summary based on research question # 6

Which model can be designed based on the best predictor(s) of Internet services' adoption and usage for secondary school learners?

In this study, the researcher (1) empirically compared the eight models and their extensions, and (2) designed the AATL model that integrates elements across the eight models. The eight models reviewed are:

- the Theory of Reasoned Action,
- the Technology Acceptance Model,
- the Motivational Model,
- the Theory of Planned Behaviour,
- a model combining the Technology Acceptance Model and the Theory of Planned Behaviour,
- the Model of PC Utilization,
- the Innovation Diffusion Theory, and
- the Social Cognitive Theory.

A unified model, called the Unified Theory of Acceptance and Use of Technology, was analysed, with four core determinants of intention and usage, and up to four moderators of key relationships. UTAUT was then tested using the original data and

found to outperform the eight individual models. UTAUT thus provides a useful tool for school managers who need to assess the likelihood of success for new technology introductions and helps them understand the drivers of acceptance in order to proactively design interventions (including training, etc.) targeted at populations of users that may be less inclined to adopt and use new systems.

7.2 CONCLUSIONS

7.2.1 Conclusions based on research question # 1

What is the effect of performance expectancy on the learners' intention to adopt and use Internet services?

Model 1 (*cf.* Table 20 under the list of tables) shows that performance expectancy sub variables are significantly influential on behavioural intention, with p values < 0.05. The following are the sub variables for performance expectancy: The use of Internet for learning purposes would save me a lot of time (PE1). The use of Internet for learning purposes would enhance the effectiveness of my learning (PE2). Mobility enables me to accomplish tasks quickly (PE3). = I know that mobile devices are also mediums for learning (PE4). Unexpected problems could be fixed at the first time of using Internet devices (PE5). I would feel more interested in study if I could use Internet devices (PE6). I would be entertained in my study when using Internet devices (PE7). Owning an Internet device would ease my learning because it would allow me to study anytime, anywhere (PE8). I would be more encouraged to learn if I could access materials anytime anywhere via mobile devices (PE9). I would have more desire to use mobile devices as a way for learning (PE10).

Hence, performance expectancy was found to have a positive influence on the behavioural intention of the learners to adopt and use Internet services in their day-to-day learning.

7.2.2 Conclusions based on research question # 2

What degree of variation exists for effort expectancy on learners' intention to adopt and use Internet services?

Effort expectancy is related to how easy an individual believes the system is easy to use. Based on the p values of Model 6 (*cf.* Table 20 under the list of tables) in this research, effort expectancy has a positive influence on the behavioural intention of the learners to adopt and use Internet services in their school activities and is highly significant with p values < 0.05 . The study therefore concludes that effort expectancy has a positive influence on the behavioural intention of the learners to adopt and use Internet services in their school activities.

Drawing upon other research, effort expectancy is more salient for females than males. As noted in this study, the gender differences found between males and females could be driven by cognitions related to gender roles. Increased age has been shown to be associated with difficulty in processing complex stimuli and allocating attention to information when using technology, both of which may be necessary when using software systems. However, this study did not discover any influence of the age on behavioural intention.

Prior research supports the notion that constructs related to effort expectancy will be stronger determinants of individuals' intention for females and for older users of technology. Drawing from the arguments made in the context of performance expectancy, the researcher expects gender, age, and experience to work in concert. Thus, this study did not find effort expectancy to be significant for females, particularly those who are older and with relatively little experience with Internet devices since the learners were mostly within the same Grade and age group. In this study, gender has been demonstrated to play a significant role in the learners' intention to use Internet services.

7.2.3 Conclusions based on research question # 3

How much of the determinants explain the usage of Internet services?

An insignificant contribution of all the four determinants (performance expectancy, effort expectancy, social influence, and facilitating conditions) was noted on the intention to use Internet services when the standardised beta coefficients were analysed. Moreover, the range of ages used for the high school learners in this study did not provide enough population segments to study differences caused by the age of the respondents. Hence, this moderating variable may be investigated in future studies, as it did not play a significant role in this study.

7.2.4 Conclusions based on research question # 4

Which is (are) the best predictor(s) of Internet services' usage given a set of determinants?

The results of this study confirm the previous technology acceptance studies regarding the strength of the performance expectancy construct in predicting behavioural intention. The current findings are however contrary to those indicating the insignificance of performance expectancy on behavioural intention of technology adoption instead this construct is the best predictor when it comes to behavioural intention. These results suggest that Internet services' adoption may be enhanced by educating teachers and learners on the potential benefits of this mode of scholarly communication in improving the accessibility and dissemination of scholarly content. In other words, learners are likely to adopt Internet services only if they clearly understand the benefits of this mode over the traditional scholarly communication system, which is the textbook.

7.2.5 Conclusions based on research question # 5

What is the effect of confounding variables (if any) on Internet services' adoption and usage?

Experience with computers was shown to have a significant impact on the acceptance of technology indicated by the significance levels found in the study. In fact, interpretation of the model with the data extracted for those who have used Internet devices persistently in the past has a much higher intention of adoption and use than the sample as a whole. This has a direct effect on performance expectancy, effort expectancy, social influence and facilitating conditions. Computer experience was found to be a factor of concern, particularly if the computer use could have started in primary and junior secondary level for the respondents.

7.2.6 Conclusions based on research question # 6

Which model can be designed based on the best predictor(s) of Internet services' adoption and usage for secondary school learners?

The AATL model was designed in this study by adding the constructs of the price of Internet, perceptions about Internet use, and persistent use of Internet services. The data was then analysed to determine statistical validity with tables to determine the participants' perceptions and behavioural intent towards the use of Internet services. The data produced by the statistical analysis provided a basis for the designing of this proposed model.

The AATL model (*cf.* Chapter 5, section 5.2.6.1) can be applied in Internet services through the inclusion of the business sector to assist schools in acquiring the necessary infrastructure needed to implement this model, as the price was identified to be a determining factor among learners. It is only when the learners have been afforded this opportunity that they will be able to persistently use these Internet resources and thereby transforming their perceptions about Internet device ownership and use.

7.3 THEORETICAL RECOMMENDATIONS

7.3.1 Recommendations based on research question # 1

What is the effect of performance expectancy on the learners' intention to adopt and use Internet services?

This means that unless the new technology improves efficiency or quality of the learners' work (in this case, learners' school performance); it is less likely to attract their interest on it. The integration of lessons with mobile devices like, smart phones, iPads, and laptops could spark a new interest among learners in their studies. Performance expectancy has been found to be similar to perceived usefulness in the Technology Acceptance Model; Combined Technology Acceptance Model and Theory of Planned Behaviour; outcome expectations in Social Cognitive Theory; and as relative advantage for Innovations Diffusion Theory. According to the UTAUT model, it is expected that individuals will build interest of using a certain technology if they believe that it will enable them to improve their performance in what they are doing.

7.3.2 Recommendations based on research question # 2

What degree of variation exists for effort expectancy on learners' intention to adopt and use Internet services?

Effort expectancy is the degree of ease associated with the use of the system. Effort expectancy is considered to be similar to Perceived Ease of Use from the (Technology Acceptance Model); Complexity from the (Model of PC Utilization); and Ease of Use from the (Innovation Diffusion Theory). For learners to be able to adopt and use Internet services, the schools should introduce Internet technologies that are easy to use. The model postulates that individuals are likely to show interest in technology usage if that technology is easy to use. Since age, gender and experience are considered to play significant moderating roles for effort expectancy schoolteachers should apply differentiated teaching to enhance differentiated

learning. This calls for teachers to study each learner's background and preferences when it comes to technology use before they dictate information to them.

7.3.3 Recommendations based on research question # 3

How much of the determinants explain the usage of Internet services?

The results of this study concur with other studies that the four constructs of the UTAUT have significant positive influence and impact on the behavioural intention of the high school learners to adopt and use Internet services. However, social influence depends on the context in which the users of technology are situated. For learners who come from disadvantaged backgrounds, social influence might be a non-existent factor. This indicates that secondary school learners must be allowed to use Internet technologies that they believe are easy to use and will improve their school performance. The facilitating conditions such as appropriate hardware, software, training and support should be in place from the side of the school management.

7.3.4 Recommendations based on research question # 4

Which is (are) the best predictor(s) of Internet services' usage given a set of determinants?

Among the high school learners who participated in the study, performance expectancy was found to be the most influential predictor of learners' intention to adopt and use Internet services among the four constructs of the UTAUT. The Cloud computing theoretical framework revealed the connectivity between education and the independent variables' use of ICT, ICT infrastructure, users' development (teachers and learners) and ICT available tools as it brings transformation to education.

7.3.5 Recommendations based on research question # 5

What is the effect of confounding variables (if any) on Internet services' adoption and usage?

Experience as a moderating factor should be further evaluated to determine if it is a factor in other populations. This moderating factor could be measured in a (Kindergarten to Grade 12) study to measure the impact of first computer use on both the teachers and the learners in schools.

On the other hand, Internet self-efficacy does have an impact on learners' intention to use Internet services. The influence of self-efficacy on behavioural intention suggests a reconsideration of the decision to remove this construct from the AATL model. Out of fifteen questions asked in the questionnaire, eight items did not have any significant influence on the learners' behavioural intention. Self-efficacy could further be studied in another study of R-12 learners and teachers in order to verify its importance and permanent inclusion on the adoption and use of the technology model.

7.3.6 Recommendations based on research question # 6

Which model can be designed based on the best predictor(s) of Internet services' adoption and usage for secondary school learners?

Critics of this model have argued that it is a recent model and therefore requires more validation. Scholars have argued for the UTAUT by stating that it is based on a strong theoretical foundation that results from rigorous development process of combining eight models. The UTAUT also includes aspects of the user's characteristics, as well as some prevailing conditions at the time of adoption and possible use of the technology, system or service. Further, by including voluntariness as a moderating factor, it is able to account for scenarios where technology adoption is mandatory or voluntary, which is ignored by many other models.

There may have been factors like price, perceptions and persistent use of Internet technology that were not taken into consideration in the UTAUT model as it was initially designed for big businesses, hence the recommendation that they must be included. Because of these variations in the results of the study, the researcher designed the Adoption and Application of Technology for Learning (AATL) model.

7.4 PRACTICAL RECOMMENDATIONS

7.4.1 Recommendations based on research question # 1

What is the effect of performance expectancy on the learners' intention to adopt and use Internet services?

The success of any technical innovation requires planning. Adequate planning should include three components that will improve the successful adoption and use of Internet technologies for learning. First, there should be an opportunity for all key stakeholders to meet and discuss the initiative. Second, there should be adequate provision of educational opportunities to provide the skills necessary to correctly use Internet devices. Third, adequate support for both learners and teachers should be in place including a help desk and repair centre.

Schools and districts should have manageable technology plans that include a major focus on evaluation activities and outcomes, keeping the perspective that technological applications are one element within a complete instructional process. The discussion and design of the evaluation component should begin when technology programs are conceptualised and continue throughout (and beyond) program implementation. Even if a program has begun (e.g. current teaching of CAT in schools) without an evaluation component, it still may not be too late to institute an evaluation.

7.4.2 Recommendations based on research question # 2

What degree of variation exists for effort expectancy on learners' intention to adopt and use Internet services?

In order to ease the process of learning as this research questions promotes, it should be a priority for all involved to ensure a trouble-free introduction of e-learning to the South African schools' curriculum. The teaching of CAT should not only be reserved for certain schools, but compulsory for all schools and be left to the learners to choose for themselves. This is the only way that could fast-track learners to effectively participate in meaningful learning and counteract the low levels of Internet self-efficacy noted in this research. For the new processes to be successfully introduced, it is important that courses on the new methodology be developed for the learners, the teacher in training and for practicing teachers. Technological methodology training cannot be left to schools to provide, and in future years, e-learning methodology must become an essential part of teacher training.

7.4.3 Recommendations based on research question # 3

How much of the determinants explain the usage of Internet services?

This study has identified the problems associated with the introduction of learners into Internet technology (*cf.* Chapter 1, section 1.1.1). A structured mentorship programme is recommended to ensure smooth integration into the system in order to ensure that the educational process proceeds in a stable manner. It is suggested that further developments in Internet learning regarding available resources, hardware and software and the expected developments regarding each of these be the focus of an in-depth study in order to pre-empt future problems and to plan for further stages of the scaffolding process.

7.4.4 Recommendations based on research question # 4

Which is (are) the best predictor(s) of Internet services' usage given a set of determinants?

From the perspective of performance expectancy as the best predictor, an investigation is required into what the future of the school will look like and to what extent Internet learning will play a role in shaping it. Although this study focused on learners, it has implications for teachers and parents to remain up to date with educational developments. Parents need to be well informed about the needs of the real world and what is required to develop their children into meaningful contributors to it so that they as parents can be included by exposing them to the new methodologies and become more efficient in their role that they must fulfil in their children's education.

Successful technological implementations should largely depend upon the motivation, knowledge, and skill of administrators and teachers to implement and utilise technology in effective ways to enhance learning for all students. It is imperative that teachers be fully supported in this regard through adequate pre-service preparation, on-going and state-of-the-art in-service activities, and links to local universities and other resources for additional support and learning.

7.4.5 Recommendations based on research question # 5

What is the effect of confounding variables (if any) on Internet services' adoption and usage?

The lack of Internet self-efficacy was identified as the main problem, which is also due to lack of infrastructure (facilitating conditions). There is therefore an urgent need for investment by the corporate sector and the government in not only developing a technological infrastructure for education but also a methodological training framework to ensure successful implementation of e-learning. The proliferation of technologies and their attendant methodologies in places like Europe,

is an encouraging sign for the future of e-learning pedagogy in any country that wants to keep up with changing times.

7.4.6 Recommendations based on research question # 6

Which model can be designed based on the best predictor(s) of Internet services' adoption and usage for secondary school learners?

In the UTAUT, the predictive efficiency of the model was proclaimed to explain as much as 70% of the variance on intention but this is still a subjective measure of intent to use a technology that can only be used as an indicator of personal choice.

It is also noted that most such studies adapted main constructs and moderators of the UTAUT. With the exception of some studies, like those Birth and Irvine (2009) and Helaiei (2009) established no strong support for UTAUT, the rest of the above studies found that the UTAUT model was robust (with most of the constructs being reliable).

Based on its comprehensiveness and high explanatory power in comparison to other technology acceptance and use models as well as its acceptability, the UTAUT model was adapted for guidance of this study. It should be noted however that although the UTAUT model is very promising in enhancing our understanding of technology acceptance, it still needs modifications to suit industry type and specific research settings. To enhance the efficiency of the UTAUT model, this study proposed additions of price of Internet, persistent use, and perceptions about Internet use (AATL model).

As districts and schools consider and reconsider putting theory into practice, they should include representatives of all groups who might potentially be affected, both in the short and long term, by Cloud computing application. All stakeholders should strive to reach consensus on the purpose and intended outcomes of the technology. It should not be something that is imposed on people by the government of the day without consultation. This consensus should be documented as specifically as

possible, including the qualification and quantification of all anticipated outcomes, and not just for the sake of using Internet technology.

7.5 RECOMMENDATIONS FOR FURTHER RESEARCH

7.5.1 Other research that can be conducted is to use a similar tool to that used in this study to survey schools in various stages of implementing Cloud computing.

7.5.2 The AATL model (price, persistent use, and perceptions) proposed in this research can be used to study other contexts which are similar to the one in which this research was conducted.

7.5.3 Further research can introduce other factors in order to build more comprehensive study such as regions, cultures and nations. Moreover variables need to be considered by size (large, medium, and small), or other potential differences. The aspects listed above will lead to another change in the study results.

7.5.4 In order to liberally generalise the results, the survey should be conducted in a number of schools. Those schools need to be similar, for example, all the schools have to be either private or public schools, specifically primary, or senior secondary schools, all of them should serve a particular population from rural areas, urban areas, or semi-urban areas (villages, cities, townships or informal settlements respectively).

7.5.5 In addition, the suggestions for further research in the area of information technology regarding Internet services in a secondary school context, should concentrate more on moderators including gender, age, education, experience, and level of reading and writing, with a bigger sample size to investigate the impact of these moderators on usage behaviour.

7.5.6 The following are questions that need time for one to formulate a future

research plan. What is the contribution of learners' beliefs about what people expect from them in Internet services' adoption and use (social influence)? Do peers and teachers affect learners' perceptions of ICT adoption and application?

7.5.7 Self-efficacy was found to be a very important determinant. This determinant was strongly related to training, so it would be useful for further research to find out about the scope of training and the type of training that would be suitable for teachers and learners in order to promote their Internet usage.

7.6 LIMITATIONS

The findings of this study should only be applied to this unique setting. The conclusions must be evaluated by conducting a confirmation study before any attempt is made to project these findings on another school setting. Learner populations in other school environments may have different model analysis and distributions than this study respondents' pool. In mandatory use situations where learners log onto the Internet at school using a password, a more direct determination of adoption and use may be informative.

7.7 CONCLUSION

The UTAUT model proved to be an easy-to-use tool that schools can implement as one way to better understand the effect of performance expectancy, effort expectancy, social influence, and other confounding variables on behavioural intention. This research explored innovative ground in Information Systems research through a multi-method approach using other available Internet devices to support technology adoption for learning. The use of the learners' social context, through informal Internet devices was suggested to support both the prediction of technology usage through the UTAUT model, and the support of the application, using the

proposed AATL model as the contextual channel to encourage Internet services' adoption.

The results of this research can be used to improve the implementation process by developing appropriate interventions that address the unique needs of each school. This study provides a foundation upon which other researchers can explore the relationship between the learning context and technology acceptance. The research also added to Diffusion of Innovation research in illustrating how the AATL can be used to successfully diffuse technology throughout the schools.

In addition to outlining implications for theory and practice, this chapter outlined the ideas for future research. It concluded with the limitations of this research. In conclusion, this research breaks new ground in IS research that has the potential to aid Information Technology leaders in efficiently and successfully implementing new technologies in their schools.

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LIST OF APPENDICES

APPENDIX A: PARTICIPANT INFORMATION LEAFLET AND ASSENT FORM



University of Fort Hare
Together in Excellence

TITLE OF THE RESEARCH PROJECT: *DETERMINANTS OF CLOUD COMPUTING: ADOPTION AND APPLICATION BY HIGH SCHOOL LEARNERS*

RESEARCHERS NAME(S): Nceba Nyembezi

ADDRESS:

CONTACT NUMBER:

What is RESEARCH?

Research is something done to find new knowledge about the way things (and people) work. Research projects or studies are used to help find out more about disease or illness. Research also helps to find better ways of helping, or treating children who are sick.

What is this research project all about?

Determinants of Internet services' adoption and use by high school learners in East London.

The duration of the research project?

Learners will be given questionnaires on factors affecting their use of Internet, which will take about 30 to 45 minutes to complete. After that, their responses will be analysed and within five months the study will be complete.

Why have I been invited to take part in this research project?

High school learners can benefit from using Internet services in order to enhance their learning.

Confidentiality

The learners' names will be protected, and their responses will be used only for research purposes.

Who is doing the research?

The researcher is Nceba Nyembezi, a teacher who is doing a research study for Doctor of Philosophy in Education with the University of Fort Hare.

What will happen to me in this study?

Respondents will be given a questionnaire, which will take about 30 minutes to complete within one day.

Can anything bad happen to me?

There are no risks involved for participating in the study.

Who else is involved in the study?

There are about 286 learners from Grades 10, 11, and 12 who are expected to participate in the study and they are all from your school.

Can anything good happen to me?

There are no immediate benefits for the study. However, the insights gained from this study could be used to design teacher training that helps foster computer use in effective and meaningful ways that could enhance your learning.

Will anyone know I am in the study?

Your name, and the information you supply will be kept confidential in all publications pseudonyms will be used to protect your identity.

**Who can I talk to about the study?**

The researcher's contact details are given above.

What if I do not want to do this?

You can refuse to take part even if your parents have agreed to your participation. You can stop being in the study at any time without getting in trouble.

Do you understand this research study and are you willing to take part in it?

YES

NO

Has the researcher answered all your questions?

YES

NO

Do you understand that you can pull out of the study at any time?

YES

NO

Signature of Child

Date

APPENDIX B: PARENTAL CONSENT FORM



University of Fort Hare
Together in Excellence

PARTICIPANT INFORMATION LEAFLET AND CONSENT FORM FOR USE BY PARENTS/LEGAL GUARDIANS

TITLE OF THE RESEARCH PROJECT: *DETERMINANTS OF CLOUD COMPUTING: ADOPTION AND APPLICATION BY HIGH SCHOOL LEARNERS*

REFERENCE NUMBER:

PRINCIPAL INVESTIGATOR: N. Nyembezi

ADDRESS:

CONTACT NUMBER:

Your child (*or ward, if applicable*) is being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please ask the study staff or doctor any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how your child could be involved. Also, your child's participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you or your child negatively in any way whatsoever. You are also free to withdraw him/her from the study at any point, even if you do initially agree to let him/her take part.

This study has been approved by the **University Research Ethics Committee at the University of Fort Hare** and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

What is this research study all about?

This research seeks to investigate factors that facilitate or hinder learners from accessing and using Internet in order to improve their learning.

Why has your child been invited to participate?

High school learners stand a good chance of benefiting from using Internet services as a tool to enhance their learning even at higher institutions.

What will your responsibilities be?

To give your child permission to participate in the research project, by answering the questionnaire.

Will your child benefit from taking part in this research?

There are no immediate personal benefits for taking part in this research. However, the insights gained from this study could be used to design teacher training (in-service and pre-service) that helps foster computer use in effective and meaningful ways that could enhance student learning.

Are there any risks involved in your child taking part in this research?

There are no risks involved for your child's participation in the study.

If you do not agree to allow your child to take part, what alternatives does your child have?

Your child is free to withdraw any time from the study, as participation is voluntary, your child will not suffer any negative consequences.

What will happen in the unlikely event of your child getting injured in any way, as a direct result of taking part in this research study?

Nothing will happen to your child, as there are no injuries anticipated.

Will you or your child be paid to take part in this study and are there any costs involved?

You or your child will not be paid to take part in the study, but out-of-pocket expenses will be covered for each study visit. There will be no costs involved for you if your child does take part.

Is there anything else that you should know or do?

You can contact **Prof A. Bayaga** at telephone [REDACTED] if you have any further queries or encounter any problems.

You will receive a copy of this information and consent form for your own records.

Assent: Children with an age of 7 and above must give assent to participate in research

Declaration by parent/legal guardian

By signing below, I (*name of parent/legal guardian*)

..... agree to allow my child (*name of child*)
..... who is years old, to take part in a research
study titled (**DETERMINANTS OF CLOUD COMPUTING: ADOPTION AND
APPLICATION BY HIGH SCHOOL LEARNERS**)

I declare that:

I have read or had read to me this information and consent form and that it is written in a language with which I am fluent and comfortable.

If my child is older than 7 years, he/she must agree to take part in the study and his/her ASSENT must be recorded on this form.

I have had a chance to ask questions and all my questions have been adequately answered.

I understand that taking part in this study is **voluntary** and I have not been pressurised to let my child take part.

I may choose to withdraw my child from the study at any time and my child will not be penalised or prejudiced in any way.

My child may be asked to leave the study before it has finished if the study doctor or researcher feels it is in my child's best interests, or if my child do not follow the study plan as agreed to.

Signed at (*place*) on (*date*)

.....
Signature of parent/legal guardian

.....
Signature of witness

Declaration by investigator

I (*name*) declare that:

I explained the information in this document to
.....

I encouraged him/her to ask questions and took adequate time to answer them.

I am satisfied that he/she adequately understands all aspects of the research, as discussed above

I did/did not use an interpreter (*if an interpreter is used, then the interpreter must sign the declaration below*).

Signed at (*place*) on (*date*)

.....
Signature of investigator

Declaration by interpreter (Only complete if applicable)

I (*name*) declare that:

I assisted the investigator (*name*) to explain the information in this document to (*name of parent/legal guardian*) using the language medium of Afrikaans/Xhosa.

We encouraged him/her to ask questions and took adequate time to answer them.

I conveyed a factually correct version of what was related to me.

I am satisfied that the parent/legal guardian fully understands the content of this informed consent document and has had all his/her questions satisfactorily answered.

Signed at (*place*) on (*date*).....

.....
Signature of interpreter

.....
Signature of witness

APPENDIX C: PERMISSION LETTER TO THE ECDoE

P.O. Box 908
Butterworth
4960
30 January 2013

Office of the Superintendent-General
Eastern Cape Department of Education
Private Bag X0032
Bhisho
5605

Dear Sir/Madam

RE: REQUEST TO CONDUCT RESEARCH IN THE EAST LONDON DISTRICT

I, Nceba Nyembezi am currently registered for Doctor of Philosophy degree with the University of Fort Hare and have to complete a thesis as part of the requirements for the programme. The title of my intended study is as follows:

Determinants of Cloud computing: Adoption and application by high school learners

The purpose of the study is to investigate the factors, which determine the adoption and use of Internet services among high school learners, in order to design a model that will be relevant to a context similar to East London township schools.

I would like permission to conduct a research during the second term of 2013 in high schools in East London, Eastern Cape. As part of the data collection process, I intend to administer a questionnaire with 268 learners. I will also seek permission from the parents of the children who will participate in the study.

This study could be used to design teacher training (in-service and pre-service) that helps foster computer use in effective and meaningful ways that could enhance student learning. I am willing to share the research findings with you should these be requested.

Only the researchers will have access to the unlinked information. The information will remain confidential and there will be no “come-backs” from the answers they give. No respondent or school name will be disclosed in the study.

Their participation is voluntary and will not be forced to take part in this study. I will not put respondents in a situation where they might be at risk of harm (physically, emotionally, socially, politically, economically, and psychologically) as a result of

their participation. If they agree to participate, they may stop at any time and tell me that they do not want to go on with the study.

Thanking you in advance.

You are welcome to contact my supervisor Prof A. Bayaga at the University of Fort Hare should you need more information.

Yours sincerely

N. Nyembezi

APPENDIX D: PERMISSION LETTER TO SCHOOL PRINCIPAL

P.O. Box 908
East London
4960
29 March 2013

The Principal

.....
.....
.....

Dear Sir/Madam

RE: REQUEST TO CONDUCT RESEARCH IN YOUR SCHOOL

I, Nceba Nyembezi am currently registered for Doctor of Philosophy degree with the University of Fort Hare and have to complete a thesis as part of the requirements for the programme. The title of my intended study is as follows:

Determinants of Cloud computing: Adoption and application by high school learners

The purpose of the study is to investigate the factors, which determine the adoption and use of Internet services among secondary school learners, in order to design a model that will be relevant to a context similar to East London schools.

I would like permission to conduct a research during the second term of 2013 in your school. As part of the data collection process, I intend to administer a questionnaire with 268 learners. I will also seek permission from the parents of the children who will participate in the study.

This study could be used to design teacher training (in-service and pre-service) that helps foster computer use in effective and meaningful ways that could enhance student learning. I am willing to share the research findings with you should these be requested.

Only the researchers will have access to the unlinked information. The information will remain confidential and there will be no “come-backs” from the answers they give. No respondent or school name will be disclosed in the study.

Their participation is voluntary and will not be forced to take part in this study. I will not put respondents in a situation where they might be at risk of harm (physically, emotionally, socially, politically, economically, and psychologically) as a result of their participation. If they agree to participate, they may stop at any time and tell me that they do not want to go on with the study.

Thanking you in advance.

You are welcome to contact my supervisor Prof A. Bayaga at the University of Fort Hare should you need more information.

Yours sincerely

N. Nyembezi

APPENDIX E: QUESTIONNAIRE

Section A

Personal information

1. Gender:

- ☐ Male
- ☐ Female

2. Age

- 14
- 15
- 16
- 17
- 18 upwards

3. Please indicate which Grade you are in:

- ☐ 10
- ☐ 11
- ☐ 12

4. Residential area

- Town
- Township
- Rural area

5. What kind of Internet devices do you have?

- Smart mobile phone
- Touch pad
- Computer

6. What is your major stream?

- Economic and Management Sciences
- Humanities & Social Science
- Science & Mathematics

Section B

Questions about ability to use Internet (**Internet self-efficacy**)

I am able to use Internet services skillfully (Please circle Yes or No)

To check Internet news (e.g. weather forecast)	Yes	No
For e-booking and e-shopping	Yes	No

To download applications	Yes	No
To download interesting podcasts	Yes	No
To watch videos and listen to music	Yes	No
To process pictures	Yes	No
To deal with calculations	Yes	No
To set a reminder/alarm for a coming event	Yes	No
To translate a foreign language	Yes	No
To send messages and emails	Yes	No
To access a social network site	Yes	No
To remotely control personal computer	Yes	No
To subscribe some services by sending messages	Yes	No
To search needed information	Yes	No
To play games	Yes	No

Section C

Use of Internet for learning purposes:

I have..... (Please tick all those you have done before)

Used internet devices for library

Downloaded school documents via Internet devices

Downloaded an application that helped me learn new knowledge

Used Internet devices to search for unknown knowledge during class

Used a social network site for discussion

Interacted and communicated with teachers through Internet

Set a reminder on mobile devices to remind me of a certain deadline

Used Internet services to interact and communicate with classmates

Checked study information and feedback from teachers via mobile devices (email or SMS)

Recorded information during class (by voice recording or taking photos)

Written notes on a mobile device during class

Read an article or assignment over the Internet

Played an educational game on the Internet

Section D

<u>Performance and Effort expectancy</u> (Please tick only one per question)	Strongly Agree	Agree	Disagree	Strongly Disagree
1. To use Internet for learning purposes would save me a lot of time.	☐	☐	☐	☐
2. To use Internet for learning purposes would enhance the effectiveness of my learning.	☐	☐	☐	☐
3. To use Internet for learning would be everywhere and useful.	☐	☐	☐	☐
4. Mobility enables me to accomplish tasks quickly.	☐	☐	☐	☐
5. I know that mobile devices are also mediums for learning.	☐	☐	☐	☐
6. Mobility enables me to access real-time data.	☐	☐	☐	☐
7. Unexpected problems could be fixed at the first time by using Internet devices.	☐	☐	☐	☐
8. I would like to be able to launch a discussion on a learning forum through Internet devices.	☐	☐	☐	☐
9. I would like to be able to interact with teachers and classmates both inside and outside class via Internet devices.	☐	☐	☐	☐
10. I would like to be able to engage in class discussion if I could share my thoughts in	☐	☐	☐	☐

real-time through mobile devices.

- | | | | | |
|--|-----------------------|-----------------------|-----------------------|-----------------------|
| 11. I would feel more interested in study if I could use Internet devices. | ☐ | ☐ | ☐ | ☐ |
| 12. I would be entertained in my study by using Internet device | ☐ | ☐ | ☐ | ☐ |
| 13. It would not require me a lot of mental effort to learn because I am skilled at mobile device functions. | ☐ | ☐ | ☐ | ☐ |
| 14. It would ease my learning because it allows me to study anytime, anyplace. | ☐ | ☐ | ☐ | ☐ |
| 15. It would be easy and clear to interact with mobile devices for learning. | ☐ | ☐ | ☐ | ☐ |
| 16. It would be easier for me to ask help from others through mobile devices. | ☐ | ☐ | ☐ | ☐ |
| 17. I would be more encouraged to learn if I could access materials anytime, anywhere via mobile devices. | ☐ | ☐ | ☐ | ☐ |
| 18. It would be desirable to use mobile devices as a way for learning. | ☐ | ☐ | ☐ | ☐ |

Perceptions on Internet use

- | | | | | |
|--|-----------------------|-----------------------|-----------------------|-----------------------|
| 19. Using Internet is fun. | ☐ | ☐ | ☐ | ☐ |
| 20. Using Internet is enjoyable. | ☐ | ☐ | ☐ | ☐ |
| 21. Using Internet is very entertaining. | ☐ | ☐ | ☐ | ☐ |

Price of Internet

- | | | | | |
|--|-----------------------|-----------------------|-----------------------|-----------------------|
| 22. Mobile Internet is reasonably Priced. | ☐ | ☐ | ☐ | ☐ |
| 23. Mobile Internet is a good value for Money. | ☐ | ☐ | ☐ | ☐ |
| 24. At the current price, mobile Internet provides a good value for Money. | ☐ | ☐ | ☐ | ☐ |

Persistent use

- | | | | | |
|--|-----------------------|-----------------------|-----------------------|-----------------------|
| 25. The use of Internet has become a habit for me. | ☐ | ☐ | ☐ | ☐ |
| 26. I am addicted to using mobile Internet. | ☐ | ☐ | ☐ | ☐ |
| 27. I must use mobile Internet. | ☐ | ☐ | ☐ | ☐ |

Behavioural Intention

- | | | | | |
|---|-----------------------|-----------------------|-----------------------|-----------------------|
| 28. I intend to continue using mobile Internet in the future. | ☐ | ☐ | ☐ | ☐ |
| 29. I will always try to use mobile Internet | ☐ | ☐ | ☐ | ☐ |
| 30. I plan to continue to use mobile Internet frequently. | ☐ | ☐ | ☐ | ☐ |

Section E

<u>Use</u>				
Choose your usage frequency for each of the following:	Never	Rarely	Often	More Often
31. SMS	☐	☐	☐	☐
32. MMS	☐	☐	☐	☐
33. Ringtone and logo download	☐	☐	☐	☐
34. Java games	☐	☐	☐	☐
35. Browse websites	☐	☐	☐	☐
36. Mobile e-mail	☐	☐	☐	☐

APPENDIX F: ETHICAL CLEARANCE CERTIFICATE



University of Fort Hare
Together in Excellence

ETHICAL CLEARANCE CERTIFICATE

Certificate Reference Number: BAY02 1SNYE01

Project title: **Determinations of cloud computing: Adoption and application in Butterworth High School.**

Nature of Project: PhD

Principal Researcher: Nceba Nyembezi

Supervisor: Dr A Bayaga

Co-supervisor:

On behalf of the University of Fort Hare's Research Ethics Committee (UREC) I hereby give ethical approval in respect of the undertakings contained in the above-mentioned project and research instrument(s). Should any other instruments be used, these require separate authorization. The Researcher may therefore commence with the research as from the date of this certificate, using the reference number indicated above.

Please note that the UREC must be informed immediately of

- Any material change in the conditions or undertakings mentioned in the document
- Any material breaches of ethical undertakings or events that impact upon the ethical conduct of the research

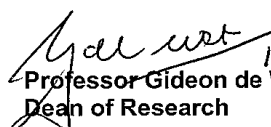
The Principal Research must report to the UREC in the prescribed format, where applicable, annually, and at the end of the project, in respect of ethical compliance.

The UREC retains the right to

- Withdraw or amend this Ethical Clearance Certificate if
 - Any unethical principal or practices are revealed or suspected
 - Relevant information has been withheld or misrepresented
 - Regulatory changes of whatsoever nature so require
 - The conditions contained in the Certificate have not been adhered to
- Request access to any information or data at any time during the course or after completion of the project.

The Ethics Committee wished you well in your research.

Yours sincerely

 19/3/13
Professor Gideon de Wet
Dean of Research

19 March 2013

LIST OF TABLES

Table 20: *Regression Analysis Summary*

Model	Independent Variables	Dependent Variables	R	R ²	Significance
1	PE 1-10	BI(1)	.425	.181	.047
2	PE 1-10	BI(2)	.346	.120	.153
3	PE 1-10	BI(3)	.519	.270	.000
4	EE 1-8	BI(1)	.352	.125	.262
5	EE 1-8	BI(2)	.326	.106	.048
6	EE 1-8	BI(5)	.439	.193	.002
7	SI 1	BI(1)	.290	.084	.214
8	SI 1	BI(2)	.234	.055	.500
9	SI 1	BI(3)	.304	.092	.533
10	FC 1	BI(1)	.280	.078	.168
11	FC 1	BI(2)	.259	.067	.251
12	FC 1	BI(3)	.220	.048	.448

Table 21: *One way ANOVA for price of Internet*

		Sum of Squares	df	Mean Square	F	Sig.
Mobile Internet is reasonably priced	Between Groups	10.590	4	2.648	3.366	.012
	Within Groups	87.298	111	.786		
	Total	97.888	115			
Mobile Internet is a good value for money	Between Groups	10.065	4	2.516	3.511	.010
	Within Groups	79.547	111	.717		
	Total	89.612	115			
At the current price, mobile Internet provides a good value for money	Between Groups	14.158	4	3.540	5.639	.000
	Within Groups	69.669	111	.628		
	Total	83.828	115			

Table 22: *One way ANOVA for persistent use of Internet*

		Sum of Squares	df	Mean Square	F	Sig.
The use of Internet has become a habit for me	Between Groups	12.390	4	3.098	4.217	.003
	Within Groups	80.792	110	.734		
	Total	93.183	114			
I am addicted to using mobile Internet	Between Groups	6.919	4	1.730	2.068	.090
	Within Groups	92.840	111	.836		
	Total	99.759	115			
I must use mobile Internet	Between Groups	7.195	4	1.799	2.908	.025
	Within Groups	68.667	111	.619		
	Total	75.862	115			

Table 23: *One way ANOVA for perceptions*

		Sum of Squares	df	Mean Square	F	Sig.
Using Internet is fun	Between Groups	14.721	4	3.680	7.450	.000
	Within Groups	54.831	111	.494		
	Total	69.552	115			
Using Internet is enjoyable	Between Groups	10.108	4	2.527	6.769	.000
	Within Groups	41.436	111	.373		
	Total	51.543	115			
Using Internet is very entertaining	Between Groups	8.835	4	2.209	4.552	.002
	Within Groups	53.855	111	.485		
	Total	62.690	115			

Table 24: *Correlations for effort expectancy*

		Internet use for learning would be everywhere and useful	Mobility enables me to access real-time data	I would like to be able to launch a discussion on a learning forum through Internet devices	I would like to be able to interact with teachers and classmates both inside and outside class via internet devices
EE1	Pearson	1	.895**	.953**	.988**
	Correlation				
	Sig. (2-tailed)		.000	.000	.000
	N	116	116	116	116
EE2	Pearson	.895**	1	.846**	.907**
	Correlation				
	Sig. (2-tailed)	.000		.000	.000
	N	116	116	116	116
EE3	Pearson	.953**	.846**	1	.946**
	Correlation				
	Sig. (2-tailed)	.000	.000		.000
	N	116	116	116	116
EE4	Pearson	.988**	.907**	.946**	1
	Correlation				
	Sig. (2-tailed)	.000	.000	.000	
	N	116	116	116	116
EE5	Pearson	.972**	.849**	.949**	.973**
	Correlation				
	Sig. (2-tailed)	.000	.000	.000	.000
	N	116	116	116	116
EE6	Pearson	.844**	.929**	.791**	.863**
	Correlation				
	Sig. (2-tailed)	.000	.000	.000	.000
	N	116	116	116	116
EE7	Pearson	.423**	.463**	.401**	.429**
	Correlation				
	Sig. (2-tailed)	.000	.000	.000	.000
	N	116	116	116	116
	Pearson	.888**	.845**	.930**	.891**
	Correlation				

	Sig. (2-tailed)	.000	.000	.000	.000
	N	116	116	116	116
Correlations					
		I would like to be able to engage in class discussion if I could share my thoughts in real-time through mobile devices	It would not require me a lot of mental effort to learn because I am skilled at mobile devices functions	It would be easy and clear to interact with mobile devices for learning	It would be easier for me to ask help from others through mobile devices
EE1	Pearson Correlation	.972	.844**	.423**	.888**
	Sig. (2-tailed)	.000	.000	.000	.000
	N	116	116	116	116
EE2	Pearson Correlation	.849**	.929	.463**	.845**
	Sig. (2-tailed)	.000	.000	.000	.000
	N	116	116	116	116
EE3	Pearson Correlation	.949**	.791**	.401	.930**
	Sig. (2-tailed)	.000	.000	.000	.000
	N	116	116	116	116
EE4	Pearson Correlation	.973**	.863**	.429**	.891
	Sig. (2-tailed)	.000	.000	.000	.000
	N	116	116	116	116
EE5	Pearson Correlation	1**	.817**	.419**	.868**
	Sig. (2-tailed)		.000	.000	.000
	N	116	116	116	116
EE6	Pearson Correlation	.817**	1**	.468**	.764**
	Sig. (2-tailed)	.000		.000	.000
	N	116	116	116	116
EE7	Pearson Correlation	.419**	.468**	1**	.347**
	Sig. (2-tailed)	.000	.000		.000
	N	116	116	116	116
	Pearson Correlation	.868**	.764**	.347**	1**

Sig. (2-tailed)	.000	.000	.000	
N	116	116	116	116

** . Correlation is significant at the 0.01 level (2-tailed).

Table 25: *Lack of Fit Test for Performance expectancy (Linearity)*

Dependent Variable: I intend to continue using mobile internet in the future

Source	Sum of Squares	df	Mean Square	F	Sig.
Lack of Fit	7.895	16	.493	.399	.979
Pure Error	109.949	89	1.235		

Table 26: *Durbin-Watson test for Performance expectancy (independence)*

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.271 ^a	.074	-.015	1.059	2.172

Table 27: *Lack of Fit Test for effort expectancy (linearity)*

Dependent Variable: I intend to continue using mobile internet in the future

Source	Sum of Squares	df	Mean Square	F	Sig.
Lack of Fit	12.795	15	.853	.722	.757
Pure Error	108.700	92	1.182		

Table 28: *Independence test for effort expectancy*

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.212 ^a	.045	-.027	1.066	2.096

Table 29: *Lack of Fit Test for Social Influence (linearity)*

Dependent Variable: I intend to continue using mobile internet in the future

Source	Sum of Squares	df	Mean Square	F	Sig.
Lack of Fit	2.165	1	2.165	1.965	.164
Pure Error	124.491	113	1.102		

Table 30: *Independence test for Social Influence*

Model Summary ^b					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.066 ^a	.004	-.004	1.054	2.013

a. Predictors: (Constant), Social Influence

b. Dependent Variable: I intend to continue using mobile internet in the future

Table 31: *Lack of Fit Test for Internet self-efficacy*

Dependent Variable: I intend to continue using mobile internet in the future

Source	Sum of Squares	df	Mean Square	F	Sig.
Lack of Fit	92.416	84	1.100	1.395	.230
Pure Error	12.617	16	.789		

Table 32: *Independence test for Internet self-efficacy*

Model Summary ^b					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.418 ^a	.174	.050	1.025	2.138

a. Predictors: (Constant), ISE15, ISE4, ISE1, ISE5, ISE14, ISE3, ISE9, ISE11, ISE10, ISE7, ISE2, ISE6, ISE8, ISE13, ISE12

b. Dependent Variable: I intend to continue using mobile Internet in the future

Table 33: Descriptive statistics for Internet self-efficacy

			Statistic	Std. Error
Studentized Residual	Mean		.0051038	.09382759
	95% Confidence Interval for Mean	Lower Bound	-	
		Upper Bound	.1807506	
		Upper Bound	.1909582	
	5% Trimmed Mean		-	
			.0531168	
	Median		-	
			.1337205	
	Variance		1.021	
	Std. Deviation		1.01055412	
	Minimum		-1.78357	
	Maximum		3.18065	
	Range		4.96422	
	Interquartile Range		1.21952	
	Skewness		.948	.225
	Kurtosis		.701	.446

Table 34: Lack of Fit Test for experience

Dependent Variable: I intend to continue using mobile Internet in the future

Source	Sum of Squares	df	Mean Square	F	Sig.
Lack of Fit	82.465	77	1.071	.913	.632
Pure Error	29.332	25	1.173		

Table 35: Independence test for experience

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.348 ^a	.121	.009	1.047	2.134

Table 36: Descriptive statistics for experience

			Statistic	Std. Error
Studentized Residual	Mean		.0003140	.09321575
	95% Confidence Interval for Mean	Lower Bound	-	
		Upper Bound	.1843285	
		Upper Bound	.1849565	
	5% Trimmed Mean		-	
			.0664173	
	Median		-	
			.2823452	
	Variance		1.008	
	Std. Deviation		1.003964	
			34	
	Minimum		-1.93144	
	Maximum		3.08433	
	Range		5.01577	
	Interquartile Range		.92454	
	Skewness		1.264	.225
	Kurtosis		1.521	.446

Table 37: Lack of Fit Test for learners' demographics

Dependent Variable: I intend to continue using mobile internet in the future

Source	Sum of Squares	df	Mean Square	F	Sig.
Lack of Fit	1.651	4	.413	.369	.830
Pure Error	121.935	109	1.119		

Table 38: Independence test for learners' demographics

Model Summary ^b					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.169 ^a	.028	.011	1.046	2.033

a. Predictors: (Constant), Age of Respondents, Gender

b. Dependent Variable: I intend to continue using mobile internet in the future

Table 39: Descriptive statistics for learners' demographics

			Statistic	Std. Error
Studentized Residual	Mean		.0000784	.09325724
	95% Confidence Interval for Mean	Lower Bound	-	
		Upper Bound	.1846462	
		Upper Bound	.1848031	
	5% Trimmed Mean		-	
			.0897280	
	Median		-	
			.0700272	
	Variance		1.009	
	Std. Deviation		1.004411	
			17	
	Minimum		-1.23094	
	Maximum		3.22304	
	Range		4.45398	
	Interquartile Range		.96515	
	Skewness		1.460	.225
	Kurtosis		1.579	.446

Table 40 Results of the regression analysis for performance expectancy

Model Summary							
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics R Square Change	F Change	df1
1	.271 ^a	.074	-.015	1.059	.074	.834	10
Model Summary							
Model				Change Statistics			
		df2		Sig. F Change			
1		105 ^a		.597			

Table 41: *Regression analysis Coefficients for PE^a*

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Zero-order	Partial	Part
	B	Std. Error	Beta					
Constant	2.117	.227		9.338	.000			
PE1	.212	.542	.289	.391	.697	-.113	.038	.037
PE2	.933	.724	1.204	1.288	.200	-.085	.125	.121
PE3	-.371	.485	-.435	-.764	.446	-.135	-.074	-.072
PE4	.167	.376	.194	.444	.658	-.121	.043	.042
PE5	-.243	.341	-.298	-.714	.477	-.137	-.070	-.067
PE6	-.319	.543	-.446	-.588	.558	-.129	-.057	-.055
PE7	-.667	.559	-.867	-1.193	.236	-.098	-.116	-.112
PE8	.467	.510	.628	.916	.362	-.080	.089	.086
PE9	-.504	.605	-.697	-.833	.406	-.111	-.081	-.078
PE10	.221	.529	.298	.418	.677	-.124	.041	.039

a. Dependent Variable: I intend to continue using mobile internet in the future

Table 42: *Correlations for Internet Experience*

		EX1	EX2	EX3	EX4	EX5	EX6	EX7	EX8	EX9	EX10
EX1	Pearson Correlation	1	.257**	.249**	.159	.236*	.080	.274**	.294**	.120	.203*
	Sig. (2-tailed)		.005	.007	.088	.011	.392	.003	.001	.200	.029
	Sum of Squares	25.552	7.000	6.586	4.328	6.259	1.845	7.379	7.966	3.103	4.828
	Covariance	.222	.061	.057	.038	.054	.016	.064	.069	.027	.042
	N	116	116	116	116	116	116	116	116	116	116
EX2	Pearson Correlation	.257**	1	.391**	.224*	.301**	.224*	.174	.139	.145	.197*
	Sig. (2-tailed)	.005		.000	.016	.001	.015	.062	.138	.120	.034
	Sum of Squares	7.000	29.000	11.000	6.500	8.500	5.500	5.000	4.000	4.000	5.000
	Covariance	.061	.252	.096	.057	.074	.048	.043	.035	.035	.043
	N	116	116	116	116	116	116	116	116	116	116
EX3	Pearson Correlation	.249**	.391**	1	.262**	.435**	.178	.286**	.296**	.305**	.299**
	Sig. (2-tailed)	.007	.000		.004	.000	.055	.002	.001	.001	.001
	Sum of Squares	6.586	11.000	27.310	7.379	11.931	4.241	7.966	8.276	8.172	7.379

EX4	and Cross-products Covariance	.057	.096	.237	.064	.104	.037	.069	.072	.071	.064
	N	116	116	116	116	116	116	116	116	116	116
	Pearson Correlation	.159	.224*	.262**	1	.279**	.215*	.229*	.328**	.241**	.462**
	Sig. (2-tailed)	.088	.016	.004		.002	.021	.014	.000	.009	.000
	Sum of Squares	4.328	6.500	7.379	28.991	7.888	5.267	6.569	9.448	6.655	11.741
EX5	and Cross-products Covariance	.038	.057	.064	.252	.069	.046	.057	.082	.058	.102
	N	116	116	116	116	116	116	116	116	116	116
	Pearson Correlation	.236*	.301**	.435**	.279**	1	.187*	.264**	.385**	.205*	.228*
	Sig. (2-tailed)	.011	.001	.000	.002		.044	.004	.000	.027	.014
	Sum of Squares	6.259	8.500	11.931	7.888	27.543	4.474	7.397	10.828	5.517	5.638
EX6	and Cross-products Covariance	.054	.074	.104	.069	.240	.039	.064	.094	.048	.049
	N	116	116	116	116	116	116	116	116	116	116
	Pearson Correlation	.080	.224*	.178	.215*	.187*	1	.138	.250**	.502**	.280**
	Sig. (2-tailed)	.392	.015	.055	.021	.044		.138	.007	.000	.002
	Sum of Squares	1.845	5.500	4.241	5.267	4.474	20.716	3.362	6.103	11.690	6.017
EX7	and Cross-products Covariance	.016	.048	.037	.046	.039	.180	.029	.053	.102	.052
	N	116	116	116	116	116	116	116	116	116	116
	Pearson Correlation	.274**	.174	.286**	.229*	.264**	.138	1	.470**	.174	.361**
	Sig. (2-tailed)	.003	.062	.002	.014	.004	.138		.000	.061	.000
	Sum of Squares	7.379	5.000	7.966	6.569	7.397	3.362	28.448	13.414	4.759	9.069
EX8	and Cross-products Covariance	.064	.043	.069	.057	.064	.029	.247	.117	.041	.079
	N	116	116	116	116	116	116	116	116	116	116
	Pearson Correlation	.294**	.139	.296**	.328**	.385**	.250**	.470**	1	.253**	.334**
	Sig. (2-tailed)	.001	.138	.001	.000	.000	.007	.000		.006	.000
	Sum of Squares	7.966	4.000	8.276	9.448	10.828	6.103	13.414	28.690	6.931	8.448
EX9	and Cross-products Covariance	.069	.035	.072	.082	.094	.053	.117	.249	.060	.073
	N	116	116	116	116	116	116	116	116	116	116
	Pearson	.120	.145	.305**	.241**	.205*	.502**	.174	.253**	1	.317**

EX10	Correlation										
	Sig. (2-tailed)	.200	.120	.001	.009	.027	.000	.061	.006		.001
	Sum of Squares	3.103	4.000	8.172	6.655	5.517	11.690	4.759	6.931	26.207	7.655
	and Cross-products										
	Covariance	.027	.035	.071	.058	.048	.102	.041	.060	.228	.067
EX11	N	116	116	116	116	116	116	116	116	116	116
	Pearson	.203*	.197*	.299**	.462**	.228*	.280**	.361**	.334**	.317**	.116
	Correlation										
	Sig. (2-tailed)	.029	.034	.001	.000	.014	.002	.000	.000	.001	
	Sum of Squares	4.828	5.000	7.379	11.741	5.638	6.017	9.069	8.448	7.655	22.241
EX12	and Cross-products										
	Covariance	.042	.043	.064	.102	.049	.052	.079	.073	.067	.193
	N	116	116	116	116	116	116	116	116	116	116
	Pearson	.339**	.292**	.271**	.321**	.241**	.267**	.261**	.231*	.259**	.533**
	Correlation										
EX13	Sig. (2-tailed)	.000	.001	.003	.000	.009	.004	.005	.013	.005	.000
	Sum of Squares	8.155	7.500	6.759	8.233	6.026	5.784	6.638	5.897	6.310	11.983
	and Cross-products										
	Covariance	.071	.065	.059	.072	.052	.050	.058	.051	.055	.104
	N	116	116	116	116	116	116	116	116	116	116
EX13	Pearson	.274**	.265**	.581**	.208*	.383**	.104	.300**	.172	.280**	.389**
	Correlation										
	Sig. (2-tailed)	.003	.004	.000	.025	.000	.269	.001	.065	.002	.000
	Sum of Squares	7.259	7.500	15.931	5.888	10.543	2.474	8.397	4.828	7.517	9.638
	and Cross-products										
EX13	Covariance	.063	.065	.139	.051	.092	.022	.073	.042	.065	.084
	N	116	116	116	116	116	116	116	116	116	116
	Pearson	.183*	.224*	.361**	.206*	.378**	.319**	.408**	.359**	.326**	.364**
	Correlation										
	Sig. (2-tailed)	.049	.015	.000	.026	.000	.000	.000	.000	.000	.000
EX13	Sum of Squares	4.983	6.500	10.138	5.974	10.664	7.802	11.707	10.345	8.966	9.224
	and Cross-products										
	Covariance	.043	.057	.088	.052	.093	.068	.102	.090	.078	.080
	N	116	116	116	116	116	116	116	116	116	116

		EX11	EX12	EX13
EX1	Pearson Correlation	.339	.274**	.183**
	Sig. (2-tailed)	.000	.003	.049
	Sum of Squares and Cross-products	8.155	7.259	4.983
	Covariance	.071	.063	.043
	N	116	116	116
EX2	Pearson Correlation	.292**	.265	.224**
	Sig. (2-tailed)	.001	.004	.015
	Sum of Squares and Cross-products	7.500	7.500	6.500
	Covariance	.065	.065	.057
	N	116	116	116
EX3	Pearson Correlation	.271**	.581**	.361
	Sig. (2-tailed)	.003	.000	.000
	Sum of Squares and Cross-products	6.759	15.931	10.138
	Covariance	.059	.139	.088
	N	116	116	116
EX4	Pearson Correlation	.321	.208*	.206**
	Sig. (2-tailed)	.000	.025	.026
	Sum of Squares and Cross-products	8.233	5.888	5.974
	Covariance	.072	.051	.052
	N	116	116	116
EX5	Pearson Correlation	.241*	.383**	.378**
	Sig. (2-tailed)	.009	.000	.000
	Sum of Squares and Cross-products	6.026	10.543	10.664
	Covariance	.052	.092	.093
	N	116	116	116
EX6	Pearson Correlation	.267	.104*	.319
	Sig. (2-tailed)	.004	.269	.000
	Sum of Squares and Cross-products	5.784	2.474	7.802
	Covariance	.050	.022	.068
	N	116	116	116
EX7	Pearson Correlation	.261**	.300	.408**
	Sig. (2-tailed)	.005	.001	.000
	Sum of Squares and Cross-products	6.638	8.397	11.707
	Covariance	.058	.073	.102
	N	116	116	116
EX8	Pearson Correlation	.231**	.172	.359**
	Sig. (2-tailed)	.013	.065	.000
	Sum of Squares and Cross-products	5.897	4.828	10.345
	Covariance	.051	.042	.090
	N	116	116	116
EX9	Pearson Correlation	.259	.280	.326**
	Sig. (2-tailed)	.005	.002	.000
	Sum of Squares and Cross-products	6.310	7.517	8.966
	Covariance	.055	.065	.078
	N	116	116	116
EX10	Pearson Correlation	.533*	.389*	.364**
	Sig. (2-tailed)	.000	.000	.000
	Sum of Squares and Cross-products	11.983	9.638	9.224
	Covariance	.104	.084	.080
	N	116	116	116
EX11	Pearson Correlation	1**	.201**	.261**
	Sig. (2-tailed)		.031	.005
	Sum of Squares and Cross-products	22.716	5.026	6.698
	Covariance	.198	.044	.058
	N	116	116	116
EX12	Pearson Correlation	.201**	1**	.378**
	Sig. (2-tailed)	.031		.000
	Sum of Squares and Cross-products	5.026	27.543	10.664
	Covariance	.044	.240	.093

EX13	N	116	116	116
	Pearson Correlation	.261*	.378*	1**
	Sig. (2-tailed)	.005	.000	
	Sum of Squares and Cross-products	6.698	10.664	28.922
	Covariance	.058	.093	.251
	N	116	116	116

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).