

**TOWARDS A PROPOSED FRAMEWORK FOR AN E-LEARNING SYSTEM**

by

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## **ABSTRACT**

The introduction of e-learning made way for advancements in learning and technology with individuals being exposed to electronic learning and teaching environments. At first, the introduction of e-learning into the educational sphere was intended to simply enhance traditional teaching and learning; however, technology then took the lead as a tool to materially enhance the concept of e-learning in education. Inevitably, technology's impact on learning drove the delivery of electronic educational content but it also caused widespread debate about best practice in the design of e-learning systems. Since then, the phenomenal influx of technology enhancements that has been created has led most learners into a digital education era that cannot now function without it.

At first, e-learning systems were forced to adapt to change as a result of e-learning trends and as a symbolic move from traditional learning to more innovative methods of learning and teaching. As such, e-learning remained affected by pedagogy, technology and curriculum changes outside of a structured, guided framework. Varying definitions exist as a result of the diverse understanding of the contributions and role of pedagogy and technology toward e-learning. There is a misconception and confusion of e-learning attributed to the lack of a formally accepted definition which would identify with the need for pedagogy principles and guide researchers to apply models and frameworks to implement and improve the provision of e-learning systems. Although the effects of technology on learning are conclusive, the current dilemma is the lack of effective alignment of the pedagogy principles to suitable technology – an issue which has now become detrimental to learning.

This study explores the various interpretations of e-learning definitions that allude to the incorporation of learning, technology and knowledge gained during e-learning interventions. However, as the research revealed a lack of any cohesive e-learning definition, this motivated the creation of a specific definition derived particularly for this study. In considering the role of technology in the e-learning environment, similar themes began to emerge that needed to be addressed holistically through e-learning.

One of these themes was a need to focus on the formulation of a structured approach and pedagogical framework for the design and development of e-learning systems.

The findings of the research identified e-learning frameworks and models that were in use. The outcome of an e-learning system framework drew on the research of extant models and frameworks and investigated the critical elements, particularly that of pedagogy in an e-learning environment. The proposed pedagogical framework for e-learning was evaluated by means of a survey of organisations that produce e-learning systems. The findings of the survey were analysed to assess the alignment and relevance of the dimensions and elements in the framework to the design and development of e-learning systems.

The proposed pedagogical e-learning framework is intended to add value to the design and development of e-learning systems with the core focus on pedagogy. In years to come, current and existing technologies and tools may become outdated, yet learning opportunities continue to evolve based on pedagogy, technology and curriculum requirements. By harmonising the synergy between pedagogy and technology, a pedagogically aligned e-learning framework can resolve the lack of pedagogy in e-learning system design and development.

**KEYWORDS:** E-learning; e-learning system; e-learning framework; information communication technology; instructional design; learning; pedagogy; stakeholders; technology

## DECLARATION

Student number: 30329248

I declare that *Towards a Proposed Framework for an E-learning System* is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

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SIGNATURE  
(Ms)

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DATE

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## **LIST OF ACRONYMS**

<b>ASTD</b>	American Society for Training and Development
<b>ADDIE</b>	Analysis, Design, Development, Implementation and Evaluation
<b>CBT</b>	Computer Based Training
<b>ICT</b>	Information Communication Technology
<b>TEL</b>	Technology Enhanced Learning

# 1. RESEARCH INTRODUCTION

## 1.1 BACKGROUND TO THE STUDY

A preliminary definition of e-learning by Sangrà, Vlachopoulos & Cabrera (2012) entails an approach to both teaching and learning, representing all or part of an educational model based on the use of electronic media and devices as tools for improving the access to training, communication and interaction that facilitates the adoption of a new way of understanding and developing learning. According to the American Society for Training and Development (2011) e-learning is defined as encompassing a wide set of applications and processes, such as web-based learning, computer-based learning, virtual classrooms, and digital collaboration. E-learning includes the delivery of learning content via the internet, intranet, extranet, networks, audio, video tape, satellite broadcast, interactive CD and CD-Rom. The ASTD (2011) definition considers e-learning to be anything electronic and internet-based, focusing on the learning delivery methods and according to Veerasamy (2010), e-learning terminology represents more than online learning, virtual learning, distributed learning, networked or web-based learning.

There is an understanding that the e-learning definition incorporates all educational activities that are carried out by learners either online, offline, via networked or stand-alone computers and electronic devices (Veerasamy, 2010). Varying definitions of e-learning exist as a result of the diverse understanding of the concept of e-learning (Morrison, 2004; Mason & Rennie, 2006). Researchers attribute the misconception and confusion of e-learning to the lack of a formally accepted definition which would identify with the need for pedagogy principles and guide researchers to apply models and frameworks to implement and improve the provision of e-learning (Khan, 2002; Mason & Rennie, 2006; Phillips, 2004; Sangra, *et al.*, 2012). An investigation into the definition of e-learning entails a discussion of education, teaching, learning and ICT, where learning, pedagogy and technology form the basic platform (Friesen, 2009). The definition of e-learning is dynamic in that it continuously adapts to trends as a result of changes in

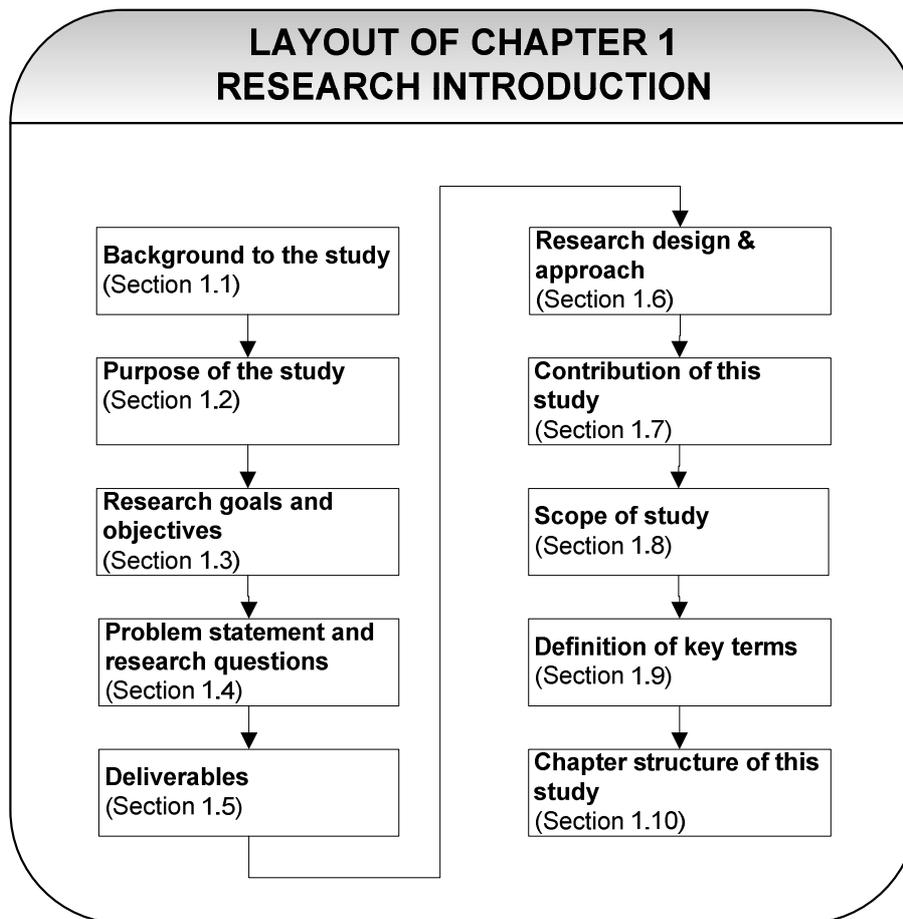
education, curricula, technology and research in the field of learning with the promise of structuring education within the context of technology (Sangrà *et al.*, 2012).

E-learning is making a significant contribution to education worldwide (Gunasekaran, McNeil & Shaul, 2002). E-learning encourages networking between learners, stimulates on-line discussions and needs to be flexible to suit all areas of learning to be delivered to anyone, anytime or anyplace in an open, flexible and distributed learning environment (Barth & Burandt, 2013 & Khan, 2005). With the help of media, animation and simulations were added to traditional learning material and increased the interaction between the learners and technology (Barth & Burandt, 2013; Ebner, 2007). Although technology-enhanced learning systems influence and encourage e-learning, its application requires careful, methodical implementation with significant effort and planning (Gunasekaran *et al.*, 2002) and a consolidated view of understanding the diversity of learners (Siemens, 2005). Extant e-learning frameworks (Clark, 1995; Dick, Carey, L., Carey, J.O., 2005; Huang *et al.*, 2008; Khan, 2001; Khan, 2004) reflect little evidence that a standardized e-learning framework is applied with a focus on pedagogical issues. Therefore to develop pedagogic e-learning systems the focus on removing elements that serve no purpose and focusing on including those elements that are useful is essential (Khan, 2005). There is largely a need to apply a consistent approach in the design and development of pedagogical e-learning systems. Various didactical scenarios, technical tools and a number of learning management systems include interactive exercises flood the growing market. In other words, the traditional education form is being accomplished with new media where the pedagogical principles that apply to the traditional method of teaching and learning will also apply to e-learning and would need to be reviewed to take into consideration the fast paced changes in technology (Govindasamy, 2002). It is necessary therefore to develop learning processes to accommodate the shift to learner-centered pedagogies for sustainable education (Barth & Burandt, 2013). Pedagogical principles form the basis of features and instruction in e-learning systems (Govindasamy, 2002). It is therefore important to consider the form of implementation for competencies that are needed and the underlying learning method to support the learning system. Facilitating e-learning into

learning environments paves the way for interaction between learners, media and gives a pedagogical significance to a technological tool (Barth & Burandt, 2013).

This study therefore focuses on the development of a framework for the design and development of e-learning systems with attention to pedagogic elements. Although the author recognises the importance of a holistic framework, the emphasis of this study is to incorporate the pedagogic elements of e-learning into dimensions of the framework to facilitate design and development of e-learning systems.

This chapter presents the background to the study (Section 1.1) and the purpose of this study is explained in terms of the motivations and purpose statement (Section 1.2), with the research goals and objectives outlined (Section 1.3) and the problem statement and research questions (Section 1.4). The deliverables are explained (Section 1.5), the research approach, design and methodology is presented (Section 1.6), including the contribution of this study (Section 1.7), the scope of this study (Section 1.8) and the definition of key terms (Section 1.9). The structure of Chapter 1 is also summarised diagrammatically below in Figure 1-1. The chapter layout of the whole dissertation (Section 1.10) is outlined in Figure 1-2.



**Figure 1-1: Layout of Chapter 1**

## **1.2 PURPOSE OF THE STUDY**

The purpose of this study is explained below in the overview, the motivations for the study and the purpose statement.

### **1.2.1 Overview**

The increase in focus of technology to implement e-learning systems takes precedence over pedagogy principles evident in the design and development of e-learning systems. This is because e-learning has predominantly been a 'one size fits all approach', but researchers have since highlighted that the one size implementation of a learning system does *not* fit all e-learning systems (Gruender, 1996; Kuriloff, 2001; Oliver, 2005).

It is one of the enduring difficulties of technology use in education that educational planners and technologists think of the technology first and thereafter investigate the educational content of applications and tend to marginalise the pedagogy elements in the design and development of e-learning systems. In addition, although continuous efforts are placed on an appropriate framework and on defining e-learning within a suitable learning environment to foster and encourage e-learning, the pedagogical principles form the basis for e-learning systems (Govindasamy, 2002). The pedagogical principles guiding traditional learning are applicable to e-learning as well but requires more advancements to cater for changes in technology (Govindasamy, 2002). Furthermore, there is a need to understand the integration of pedagogy in e-learning systems.

### **1.2.2 Motivations for the study**

The motivations for the study are detailed below. They are, firstly, to redefine e-learning to include pedagogy; secondly, to assess the focus of technology on e-learning; thirdly to evaluate extant e-learning frameworks; fourthly, to identify the elements of a structured e-learning framework, and finally to develop and design a consolidated e-learning pedagogical framework.

#### **1.2.2.1 Understanding e-learning**

The literature presents varying definitions that contribute to interpretations of the e-learning concept: that is to focus on pedagogy or technology or both. The definition of e-learning is dynamic in that it continuously adapts to trends as a result of changes in education, curricula, technology and contributions as a result of research in the field of education and learning (Sangrà *et al.*, 2012). As new tools are being introduced, the promise of structuring education within the context of technology as well as the concept of e-learning is changing (Sangrà *et al.*, 2012).

The common challenges to understand the concept of e-learning are:

- a) There is no coherent definition (Hui, 2007);
- b) The varying interpretations contribute to the confusion about what exactly e-learning is (Mason & Rennie, 2006) and
- c) E-learning means different things to different people as determined by its context (Morrison, 2004).

What is certain, however, is that the differing definitions reviewed through research highlight that the majority of the interpretations focus on technology rather than pedagogy. Definitions by Rosenberg (2001) and Gunasekaran *et al.*, (2002) are not specific to pedagogy, but present a considerable focus on technology. This is also true of subsequent authors (Koohang & Harman, 2005; Veerasamy, 2010; Zhang, Zhao, Zhou & Nunamaker, 2004). However, in contrast, others (Clark & Mayer, 2003; Warger & Dobbin 2009; White Paper on e-Education, 2004) present e-learning definitions that combine pedagogy with technology. This includes Khan (2005) and the American Society for Training and Development (ASTD) learning circuits (2011) who maintain the inclusion of pedagogy and technology in their e-learning definitions. There are yet others who state that e-learning is purely to facilitate the use of internet communication (de Villiers, 2005; Gunasekaran *et al.*, 2002; Rosenberg, 2001). As a result, a greater percentage of definitions present in this study have a significant focus on technology rather than pedagogy. Khan (2001) emphasises that e-learning needs to be defined by the importance of learner needs and maintains the view that e-learning is a move from traditional learning to more diverse, innovative methods of learning where technology benefits e-learning. Current e-learning definitions are therefore not adequate in addressing pedagogy and a more comprehensive definition is needed.

The first motivation for this study, therefore, is to investigate current definitions, incorporate the various interpretations of the definition of e-learning and propose a new merged definition.

### **1.2.2.2 Assessing the focus of technology on learning**

Studies question whether technology *can* adequately address pedagogy requirements for all the stakeholders and suggests that the effectiveness of technology is critical in an e-learning environment and question the effectiveness of many learning technology solutions to meet pedagogy needs (Jochems, van Merriënboer & Koper, 2004). What is certain is that integrating technology and education is considered in the literature to be the main motive for the increase in the provision of e-learning (Reiser & Dempsey, 2002). This motivation is, therefore, that the impact of technology on e-learning requires further exploration and discussion in line with the role of technology to facilitate the pedagogy principles.

### **1.2.2.3 Evaluation factors in an e-learning framework**

The evaluation of an e-learning framework is achievable by analyzing the pedagogical elements and conditions that support or hamper: (a) the learning and teaching styles: (b) the overall parameters of an environment: (c) the behavior of learners and (d) the approaches to an on-line learning environment (Kuchi *et al.*, 2003). According to Khan (1997), several factors help to create a meaningful environment and different dimensions of the environment must be explored to accommodate diverse learning styles and various learning needs (Khan, 2005).

The third motivation for the study, therefore, is to establish the relevance of pedagogical elements in e-learning dimensions and frameworks to make e-learning more meaningful. The study examines the extant frameworks and the relevance of the pedagogy requirements in the design and development of e-learning systems.

### **1.2.2.4 Lack of a structured e-learning environment**

The conditions under which successful e-learning solutions survive have sparked much debate (Herrington & Oliver, 2000; Oliver, 2005). Learning environments that are structured, authentic and appropriate are the basis of learning development (Reiser & Dempsey, 2002). Learner-centred approaches target the learning environment to

support and structure effective learning (Naidu, 2006) and they require guidelines to establish that a learning environment is maintained (Siemens, 2005). According to Khan (2005), an inclusive learning environment incorporates instructional design principles for a flexible electronic learning platform. Given that the learning environment facilitates skills and knowledge transfer, further resources and also internal and external factors are likely to influence the learning within an environment (Grabinger, Aplin & Ponappa-Brenner, 2007).

Therefore, the fourth motivation for this study is that there is a need to identify and combine pedagogy principles and dimensions in e-learning systems that are relevant and effective within a learning environment.

#### **1.2.2.5 Lack of a standardised e-learning system framework**

Although many extant e-learning frameworks are proposed (Clark, 1995; Dick, Carey, L., Carey, J.O., 2005; Huang *et al.*, 2008; Khan, 2001; Khan, 2004), there is little evidence for any pedagogical framework that is applied consistently in the design and development of e-learning systems. The motives and research for designing e-learning systems may vary, however a standardised approach is required to incorporate pedagogy requirements. There is a need, therefore, to develop pedagogic e-learning systems by focusing on removing elements that serve no purpose and focusing on including those elements that serve a useful function (Khan, 2005).

Therefore, the fifth motivation for this study is to provide a suitable e-learning framework to amalgamate pedagogy and technology requirements to motivate the core purpose of this research.

#### **1.2.3 Purpose statement**

In considering the motivating factors (Section 1.3.2 above) the purpose of this study is then to examine the existing elements in e-learning frameworks and to propose an appropriate pedagogic e-learning framework that incorporates the pedagogic principles.

This dissertation investigates the existing definitions for e-learning and derives a suitable e-learning definition appropriate to this research. The derivation of a standard e-learning definition is critical as the literature shows the varying interpretations and the lack of a conclusive definition for e-learning. The focus is exclusively either for technology or communication purposes and only sometimes combined with pedagogical principles. To set a new focus both on pedagogy and technology is essential considerations in e-learning systems therefore a new definition of e-learning is used in this study to establish a holistic view of the concept of e-learning. The role of technology in e-learning underpins the importance of planning its application in the pedagogical e-learning framework; however, it also identifies that there is a need to manage the pedagogical requirements.

The purpose of this research then is to propose and evaluate a pedagogical e-learning framework for the design and development of e-learning systems. Empirical research is conducted using a questionnaire to survey participant reactions to the relevance of the proposed e-learning framework.

### **1.3 RESEARCH GOALS AND OBJECTIVES**

Since the research goal is to solve the research problem and propose a feasible, inclusive framework for e-learning systems, the following research objectives are explored to achieve the research goal:

- Redefine the e-learning concept to include pedagogy, investigate the role of technology in the e-learning environment and establish the pedagogy elements in the extant e-learning frameworks.
- Propose a pedagogical e-learning framework for future e-learning system design and development.
- Evaluate the proposed pedagogical e-learning framework.

#### **Objective 1: To redefine the e-learning concept**

A review of existing research literature is to ascertain the interpretations of the e-learning concept. Due to the varying interpretations of e-learning and the lack of a conclusive e-learning definition, the aim of this research is to derive a definition of e-learning that is relevant to pedagogy through a technological platform of communication.

**Objective 2: To investigate the role of technology in the learning environment**

The aim of this objective is to investigate the literature and establish the role of technology in e-learning systems bearing in mind that the role of technology varies, depending on the design of appropriate instructional methods for different learning interventions.

**Objective 3: To evaluate the existing e-learning system frameworks**

The extant e-learning frameworks are explored to determine the extent of incorporating learning and pedagogy elements in current system design. The aim of this objective is to establish whether the frameworks under discussion make provision for essential learning elements and pedagogical principles in the e-learning system design and development.

**Objective 4: To propose an appropriate e-learning system framework**

A proposed pedagogical e-learning framework holistically combines both the concerns of pedagogy principles and technology support. The framework focus is on pedagogical principles in an e-learning environment. The aim of this objective is to develop a pedagogical e-learning system framework by planning learning outcomes and addressing pedagogical needs.

**Objective 5: To evaluate the proposed pedagogical e-learning system framework**

The proposed pedagogical e-learning framework is evaluated to validate that the relevant dimensions and pedagogical principles are integrated and assess if the framework is potentially useful.

## 1.4 PROBLEM STATEMENT AND RESEARCH QUESTIONS

### 1.4.1 Problem statement

The existing problem is that e-learning lacks a conclusive structure to implement technology solutions in line with pedagogy requirements; therefore, the nature and extent of the relationship between pedagogy and technology requires further exploration and investigation. The emphasis on the pedagogy-technology aspects in a pedagogical e-learning framework is investigated. It is proposed that learner-centered approaches should be the core focus for design interventions.

Khan (2005) maintains that e-learning systems display a significant, positive effect on learners, stakeholders, instructors, support staff and the relevant institution. As a result, the requirement is for e-learning systems to be readily available, easily accessible, flexible, learner focused, inexpensive, well structured, planned and presented within a controlled learning environment. There is much evidence of capital injection into software and hardware developments to enhance the delivery of e-learning, but the benefits are low and projects continue to fail (Penna & Stara, 2007).

As e-learning facilitates learning, it is dependent on critical conditions to enable technology as a medium to improve and advance learning (Jochems *et al.*, 2004). In maintaining an integrated approach, e-learning requires conditions to be fulfilled, namely: (a) pedagogical, technical and organizational needs; (b) a systems design perspective to include instruction, tutorials, learning material, media and (c) learner-centred to accommodate diverse learning needs in a global environment (Jochems, *et al.*, 2004). With technology as the driving force, solutions are pedagogically poor, unmanageable and expensive (Jochems, *et al.*, 2004). There is an understanding that the evolution of technology in e-learning environments dictates the e-learning content and processes rather than incorporating pedagogic principles and determining the actual learning requirements for learners (Beetham & Sharpe, 2013). According to Beetham & Sharpe (2013) advancements in technology are happening at a faster rate

than the alignment of pedagogy to technology and e-learning systems run the risk of being pedagogically ineffective.

Since the pedagogical framework for e-learning systems is a critical factor it should ideally prescribe the key pedagogical requirements and guidelines in order to communicate learning (Barth & Burandt, 2013; Brown, 2003; Govindasamy, 2002; Kuilik, 1994; Spender, 2002; Strommen & Lincoln, 1992) especially since some e-learning system vendors deliberately distance themselves from the pedagogical principles (Govindasamy, 2002). Researchers (Beetham & Sharpe, 2013) emphasise the recent trend in pedagogical thinking is to identify the individual learning capacities and learner needs where learners are now featuring as an essential component in contributing to their own learning. Furthermore, pedagogy describes the manner in which learning activities are planned, structured and implemented specific for learning purposes. Over the years, researchers identify the relative increase in the focus of technology to implement e-learning systems rather than in the learning elements itself (Brown, 2003; Kuilik, 1994; Spender, 2002; Strommen & Lincoln, 1992). However, researchers acknowledge that a one-size implementation of a learning system is not suitable for all learning systems (Gruender, 1996; Kuriloff, 2001; Oliver, 2005). Although technology-enhanced learning systems influence and encourage learning, its application requires a methodical implementation with significant effort, planning and a consolidated view of understanding the diversity of learners (Beetham & Sharpe, 2013; Gunasekaran *et al.*, 2002; Siemens, 2005).

#### **1.4.2 Research Questions**

The main research question addressed in this research is:

##### **What are the essential elements in an e-learning system framework?**

The purpose of the sub research questions below is to help further analyse and answer the main research problem and to guide the investigation of the study. These sub-research questions are:

1. **What is the current state-of-the-art of e-learning and its definition, concept and relevance to learning and technology?**
2. **What is the role and impact of technology in the e-learning environment?**
3. **What frameworks and pedagogy principles currently exist to guide e-learning systems design and development?**
4. **What is an appropriate framework and its contributing elements to develop and enhance the design of e-learning systems for learning and technology?**
5. **Does the use of the proposed e-learning systems framework contribute to the future design of an e-learning system?**

## **1.5 DELIVERABLES**

The deliverables in this section are a result of the activities carried out through the research to address the research objectives. The deliverables per research activity in this section are:

### **1.5.1 Literature study**

The first deliverable is to conduct a comprehensive literature study (Chapter 2) to investigate the Research Sub Questions 1, 2 and 3 by:

- An assessment of the current status of e-learning by detailing definitions and interpretations of e-learning. A consolidated e-learning definition is presented in line with pedagogy and technology considerations to improve the e-learning technology alliance.
- An exploration of the roles of technology and its appropriate function in the e-learning systems environment.
- An identification of the existing e-learning frameworks and pedagogy principles and an analysis of the extent to which pedagogical factors are built-in into the frameworks.

### **1.5.2 Proposed e-learning system framework**

The second deliverable is a proposed pedagogic e-learning framework (Chapter 4) that emanates from the findings of the literature study. The pedagogical framework is intended to primarily address the inclusion of pedagogic requirements from the inception of an identified need for e-learning systems. The proposed pedagogic e-learning framework is used in the design and development of e-learning systems.

### **1.5.3 Questionnaire to evaluate the proposed framework**

The third deliverable is a questionnaire which is used as a research instrument in this study. The empirical research (Chapter 3) is conducted through a survey which is used to evaluate the proposed pedagogic framework for e-learning systems. The questionnaire addresses the research questions in this study using a sample group of 20 participants who are involved in the design and development of e-learning systems. The participants are used in the evaluation of the proposed e-learning framework. The questionnaire is tested in a pilot study through a group of selected individuals. The actual sample group comprises of role players involved in the design and development of e-learning systems.

### **1.5.4 Statistical analysis of data**

The fourth deliverable entails a statistical analysis, utilising graphical representation and explanations of the data collected, through the defined evaluation questionnaire (Chapter 5). The analysis seeks to evaluate the potential effectiveness of the proposed pedagogic framework for the design and development of e-learning systems. The selection of the sample group is based on the response to an initial request to participants outlining the requirements and scope of the study. The response to the initial request is relatively low and results in responses from only 20 participants. Therefore the sample group consists of 20 participants of which response is received from only a further 7 participants. The author acknowledges that the sample group is

relatively small; however it is envisaged to repeat this survey as an interview format or as an open online survey to ensure that the response is relatively higher and the sample group includes a wider scope of participants as initially outlined in the role players required. This is the initial evaluation and on the basis of the research and outcomes of the survey and suggestions it is the view of the author to repeat this survey and conduct a further interview process to solicit detailed information on the responses received.

## **1.6 RESEARCH APPROACH – DESIGN AND METHODOLOGY**

A quantitative research approach is adopted in this study where a survey is conducted to solicit information.

### **1.6.1 Research design**

The research design consists of the following activities to achieve the research objectives. The deliverables in Section 1.6 above relate to the outcome of each research activity.

#### **Research activity 1: Literature study to analyse the current state of e-learning**

A comprehensive literature study (Chapter 2) focuses on:

- An analysis of the current state of e-learning through e-learning definitions to enable the derivation of a new definition of e-learning suitable to this study.
- The impact of technology on learning in an e-learning environment.
- The extant e-learning frameworks and models and the pedagogical principles.

#### **Research activity 2: Development of a proposed pedagogic e-learning framework**

A framework for the design of e-learning systems is developed in the field of ICT and education to focus on pedagogy as a central element to e-learning systems design and

development (Chapter 4). The literature study largely contributes to the motivation for developing the proposed pedagogic e-learning framework.

### **Research activity 3: Evaluation of the proposed e-learning framework through collection of data**

The proposed pedagogic framework is evaluated using empirical research (Chapter 4). The research seeks to collect data from role players involved in the design and development of e-learning systems under real-life conditions through a survey. The main instrument employed in this research is questionnaires to administer to role players from local and international organisations and include: analysts; designers; developers; project managers and executive managers. The survey is selected to distribute to the selected target audience through an electronic mail attachment over geographically dispersed local and international organizations involved in producing e-learning systems. The survey is suitable for this study to reach the target group due to geographical restrictions. The pilot study is conducted among a group of selected individuals where recommendations and suggestions on improvements in the questionnaire are incorporated. The participants are selected on the basis of non-probability purposive sampling technique from a sample population of local and international ICT companies that focus on e-learning system design and development bearing in mind that the population is limited in this area of study. This study develops and validates a survey instrument using questionnaires that ascertains and assesses the responses of role players towards the proposed e-learning framework. A questionnaire is constructed as a measuring instrument to facilitate the collection of data for input to the final statistical analysis of the data (Babbie & Mouton, 2011 and Leedy & Ormrod, 2013). Due to time constraints there is insufficient time to interview the participants.

### **Research activity 4: Statistical analysis of the e-learning framework**

The evaluation of the e-learning framework involves the collection of data by means of administering the questionnaire to participants. The data is tabulated, interpreted and statistically analysed to ascertain the participant's responses to the evaluation of the

proposed framework (Chapter 5). A descriptive analysis is then conducted. The analysis aims to determine whether the proposed pedagogic e-learning framework is thought to be potentially effective for the design of e-learning systems.

### **1.6.2 Pilot study and evaluation**

A pilot study and evaluation stage is conducted among a selected group of individuals. The pilot study seeks to determine whether there are inconsistencies in (a) the structure and formatting of the questionnaire; (b) the understanding and grammar of the questions and (c) serves as confirmation of the allocated time to complete the questionnaire. The recommendation and results of the pilot study are used to adjust the questionnaire, prior to the evaluation of the proposed framework administered to participants.

### **1.6.3 Validity and reliability**

The collection of data is conducted through a standardised self-administered questionnaire where the participants evaluate the proposed pedagogic e-learning framework. Permission has been obtained from participants prior to conducting the survey (Appendix B - Letter of Consent).

### **1.6.4 Ethical clearance**

Ethical clearance has been granted from the UNISA Ethical Clearance Committee to enable the distribution of the questionnaires (Appendix D). The confidentiality and anonymity of the participants are maintained ensuring that the data results are used only for statistical analysis. The study focuses on gaining an understanding of the state of e-learning and the impact of technology on learning. Further insight into existing e-learning models and frameworks are conducted with the aim of proposing an e-learning framework for e-learning system design and development from a pedagogical perspective. The study aims to achieve the outcomes through a quantitative approach.

## **1.7 CONTRIBUTION OF THIS STUDY**

The contribution of this study is to provide a pedagogical e-learning framework to incorporate pedagogical principles before, during and after the design and development of e-learning systems. The use of the framework is aimed at all role players engaged in the design and development of e-learning systems. During the initial stages of conceptualising an e-learning system, certain factors and considerations ought to be controlled and managed through a structured approach. The proposed pedagogical framework in this study aims to provide a structure to define pedagogical requirements from the onset and plan and accommodate amendments that may arise in the course of the system.

This study benefits and equips academic and business sectors with a pedagogically aligned e-learning framework to encourage and adapt the requirements of e-learning systems. Ultimately, the learner, instructors and teachers - as end-users of the system - derive maximum benefit from a structured, pedagogically aligned e-learning system.

## **1.8 SCOPE OF STUDY**

In a study to design a framework enhancing the conformity of e-learning systems, the research draws from several national and international literary sources on the subject and encourages the platform for further investigation and research into e-learning systems design and development from a pedagogical perspective. The objectives are to:

- (a) Derive a relevant definition for e-learning;
- (b) Investigate the role of technology on e-learning;
- (c) Conduct an investigation into extant e-learning frameworks and models;
- (d) Develop and propose a pedagogical framework for the design and development of e-learning systems;

- (e) Evaluate and analyse the proposed pedagogic framework using a relevant sample population to ascertain its effectiveness; and
- (f) Conclude with the findings, recommendations and conclusions of this study.

### **1.8.1 Assumptions**

This research highlights the following assumptions:

- E-learning enhances the flexible learning approach to make learning accessible and is dependent on technology to communicate learning.
- There is a global need and increasing operational purpose for the validation of e-learning systems. Hence there is a need to present a consolidated, relevant, acceptable pedagogic e-learning framework.
- Learning through technology has a significant impact on learning for all ages and is relevant in all areas of instruction.
- There are no financial implications planned for this study.

### **1.8.2 Limitations**

The limitations falling outside the scope of this study are explained as follows:

- This study excludes research into e-learning systems failure, due to many unreported instances. This lack of data prevents this study from investigating and examining the causes of e-learning systems failure and makes it difficult to map a structured approach based on the reports of past mistakes and experiences.
- This quantitative study is relatively small in nature may constitute findings where varying interpretations exist.
- The response to the survey is limited to 7 participants due to the unresponsiveness of the questionnaire.
- Time constraints did not allow for further interviewing of the participants.

- The literature study considers the analysis of five extant e-learning frameworks or models, where other frameworks may in fact be applicable.
- The survey research method uses non probability purposive sampling which limits the study to generalising the empirical research. Therefore, the results from this study cannot be generalised to apply to the respective population.

### **1.8.3 Delimitations**

- The study conducts a survey among stakeholders that are identified through the process of design and development of e-learning systems and results in a relatively low population size.
- The evaluation of the extant e-learning frameworks is based on those frameworks highlighted in this study, bearing in mind that other frameworks and models pertaining to this study would have applied.

## **1.9 DEFINITION OF KEY TERMS**

The key terms used in this study are defined as follows:

**Agile:** The term agile is defined as “the use of continuous stakeholder feedback to produce high quality consumable code through use cases and a series of short time-boxed iterations. It has four key features: stable code, stakeholder feedback, self-directed teams and sustainable pace (Mirnalini & Raya, 2010:242).

**E-learning:** According to Khan, e-learning can be defined as “an innovative approach for delivering a well-designed, learner-centered, interactive and facilitated learning environment to anyone, anyplace, anytime, by utilizing the attributes and resources of various digital technologies along with other forms for learning materials suited for open and distributed learning environment” (Khan, 2010:42).

**E-learning system:** Qwaider (2011:59) defines an e-learning system as “learning using electronic means: the acquisition of knowledge and skill using electronic

technologies such as computer and internet based courseware and local and wide area networks”.

**E-learning framework:** Kuchi, Gardner and Tipton (2003:3) define an e-learning framework as “providing the overall parameters, conditions and support for various learning and teaching styles, information seeking behaviors and multiple intelligence approaches to learning in any type of classroom or online learning environment”.

**Information Communication Technology (ICT):** The term “Information Communication Technology” commonly refers to “a very broad description term for any hardware or software, or even any activity that is related to the use of computers for the generation, storage, transmission and retrieval of information in an electronic format”. Previously known as Information Technology or abbreviated as IT, the proliferation of communication tools in the information age and communicating knowledge became a priority and this led to the coining of the term Information Communication Technology (Mason & Rennie, 2006:60).

**Instructional design:** Broderick (2001:1) defines instructional design as “the art and science of creating an instructional environment and materials that brings the learner from the state of not being able to accomplish certain tasks to the state of being able to accomplish those tasks”.

**Learning:** Learning may be defined as a relative change in behaviour, which is demonstrated through experiences encountered by the learner (Klein, 2012).

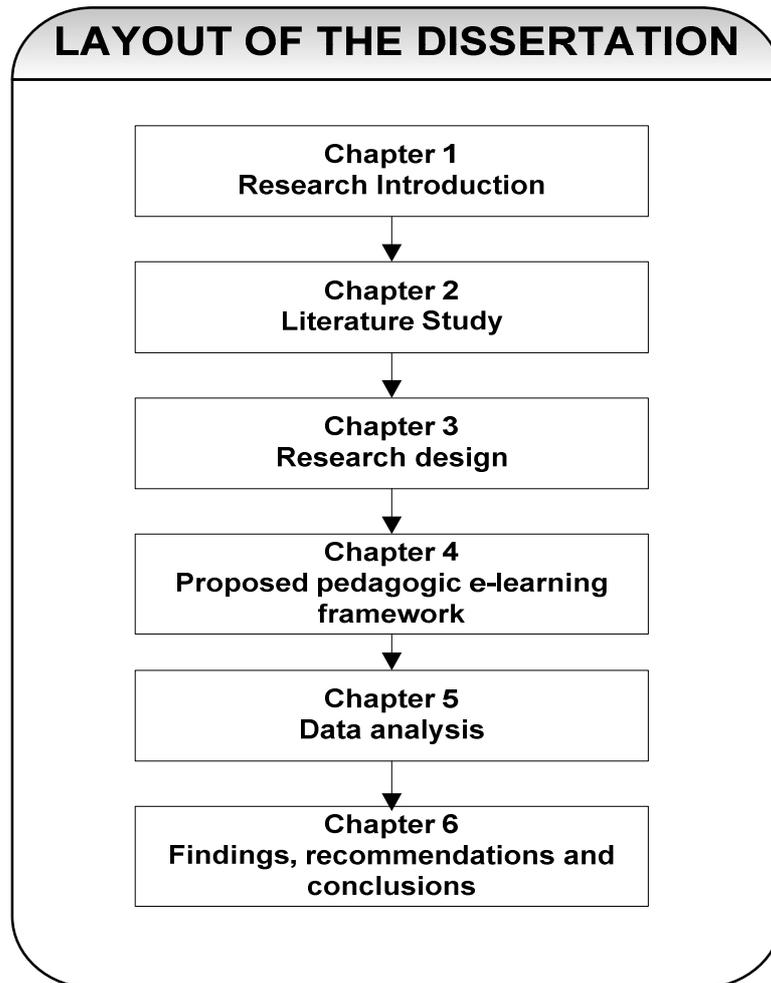
**Pedagogy:** The definition of pedagogy suggested by Peel (2013) relates to the study of various methods of teaching, establishing the aims, goals and objectives of education and the manner in which goals and objectives may be achieved. Theories and educational psychology have a great impact on the field of education.

**Stakeholders:** According to Campbell and Rozsnyai (2002) stakeholders may be defined as individuals, students, society, and government that participate in or benefit from the provision of education.

**Technology:** Technology defined by Banta (2009:7): “is a broad concept that deals with use and knowledge of tools and crafts and how its use affects the ability to control and adapt to the social and physical environment. Technology can refer to material, objects of use to humanity, such as machines, hardware or utensils, but can also encompass broader themes, including systems, methods of organization, and techniques”.

## **1.10 CHAPTER STRUCTURE OF THIS STUDY**

The outline of Chapter 1 to Chapter 6 in this dissertation is presented diagrammatically in Figure 1-2 below. The study is structured such that the first chapter provides an introduction to the research detailing the purpose, objectives and research questions. Chapter 2 presents the literature study. In Chapter 3 the empirical research employed for this study is discussed and in Chapter 4 the framework for the design of e-learning systems is detailed. Chapter 5 discusses and interprets the statistical analysis of the data collected. The concluding Chapter 6 presents the findings, recommendations and conclusions. The detail of the applicable appendices referenced in the chapters is provided in a list at the end of the Table of Contents.



**Figure 1-2: Chapter Layout for this dissertation**

## 2. LITERATURE STUDY

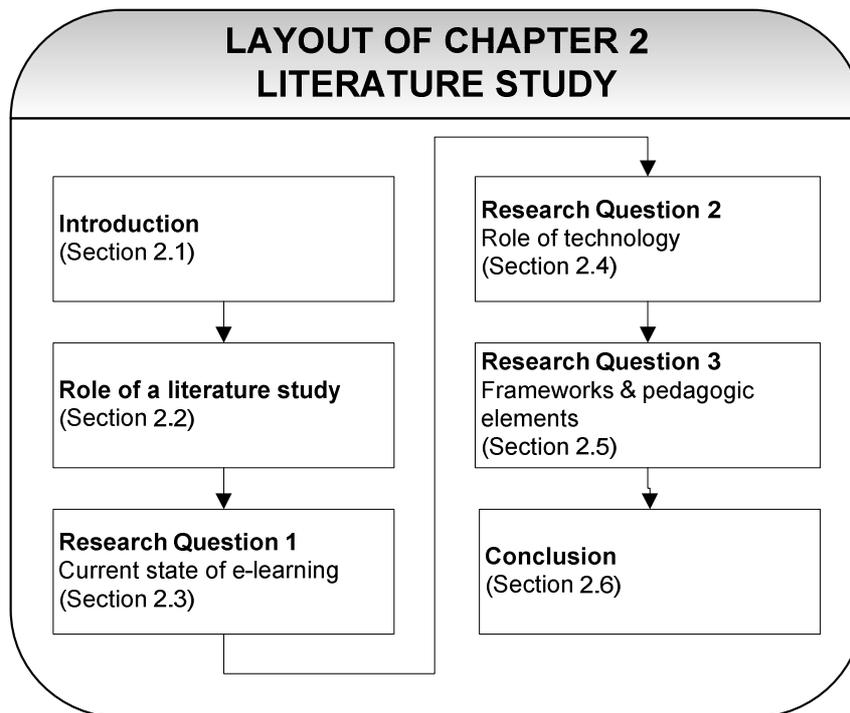
### 2.1 INTRODUCTION

The introduction to this research study is presented in Chapter 1 and concluded with a structure for the remainder of the study. This chapter is committed to achieve the Objectives 1, 2 and 3 through the literature study. Research Question 4 is addressed in Chapter 4 and Research Question 5 is addressed in Chapter 6. All the other research questions are analysed and investigated in Chapter 2. The questions are as follows:

- **Research Question 1:** What is the current state-of-the-art of e-learning and its definition, concept and relevance to learning and technology? This is concluded in Section 2.3.
- **Research Question 2:** What is the role and impact of technology in the e-learning environment? This is considered in Section 2.4.
- **Research Question 3:** What frameworks and pedagogic principles currently exist to guide e-learning systems design and development? This is investigated in Section 2.5.

The focus in this chapter is to identify the role of a literature study and explore the research questions in the references that reflect the discussion within a pedagogical focus. Figure 2-1 depicts the structure of Chapter 2 as reflected by the Research Questions 1 – 3 above.

The literature study in this chapter guides the discussion and development of the proposed framework detailed in Chapter 4.



**Figure 2-1: Layout of Chapter 2**

## 2.2 ROLE OF A LITERATURE STUDY

A literature study provides insight into the theoretical research behind this study's objectives and guides the selection of research sources to answer the research problems. A literature study also performs several functions in determining and dictating the requirements for research (Mouton, 2001). A structured, comprehensive literature study essentially guides the research by identifying an awareness of the topic's discussion in the field of research (Mouton, 2001).

According to Bless and Higson-Smith (2000:20), a literature study is suitable for the following reasons:

- To strengthen the theoretical framework of research being reviewed.
- To identify new trends and developments in the respective field of research.
- To ascertain the current state of research for strengths, weaknesses, gaps and future requirements.

- To draw comparisons on research already conducted to ascertain factors of importance, irrelevance and influence.
- To examine the concepts in previous research with the purpose of referencing and comparing research in similar topics.

The above purposes of a literature study are appropriate in this study to (a) re-define the e-learning concept and (b) to propose a pedagogical e-learning framework. However, it is a concern that elements of prior research may influence one to accept theories and research without further critical evaluation or analysis as it may lead to research being biased or one-sided (Mouton, 2001). It is, therefore, the authors aim to conduct and maintain investigations and analysis in a fair, well-thought-out, balanced approach to prevent such biases.

## **2.3 RESEARCH QUESTION 1**

<b>What is the current state-of-the-art of e-learning and its definition, concept and relevance to learning and technology?</b>
---

### ***2.3.1 Introduction to Research Question 1***

The research into the definitions of e-learning establishes the core focuses of e-learning for effective design and development of e-learning systems for this study. The fact that the literature presents a wide interpretation of the concept of e-learning gives impetus to define e-learning more comprehensively to streamline this study's focus on design. A new definition for e-learning is required for further clarity to determine the contributing factors of importance to be incorporated in the proposed pedagogic e-learning framework. The next Section (2.3.2) attempts to derive a suitable definition of e-learning.

### **2.3.2 Defining e-learning**

Since a misunderstanding exists about the requirements of e-learning as a result of the diverse definitions based on differing perspectives in the literature (Morrison, 2004; Mason & Rennie, 2006) there is a lack of a comprehensive formally accepted definition. This results in some misconception and confusion in defining and understanding e-learning (Mason & Rennie, 2006; Phillips, 2004 and Sangra, *et al.*, 2012).

Researchers indicate that a concise definition of e-learning identifies key elements and guides researchers to apply models and frameworks to implement and improve the provision of e-learning in learning (Khan, 2002; Sangra, *et al.*, 2012). Such an investigation of the definition and usage of e-learning entails a discussion of education, teaching, pedagogy and ICT where pedagogy and technology are key elements bearing in mind the diversity of understanding of the concept (Friesen, 2009).

Rosenberg (2001) defines e-learning as the employment of internet technologies to distribute a range of solutions to improve and develop both knowledge and performance. The definition contains the three elements and explains that e-learning is networked, delivered through conventional internet technologies by means of a computer, and focuses on learning beyond traditional methods. E-learning is internet-enabled and allows people and organisations to track changes in the global economy that now occur on internet time (Gunasekaran *et al.*, 2002).

Although researchers argue that electronic learning is inclusive of both teaching and learning, Waight, Willging & Wentling (2002) point out that based on current technology, it is not solely dependent on the internet as a delivery mechanism. Accordingly, the full definition of e-learning requires the acquisition and application of knowledge that is disseminated and facilitated mainly by electronic resources. The technology based learning approach is an additional mechanism to define e-learning where learning material is delivered electronically to remote learners (Zhang *et al.*, 2004).

Clark & Mayer (2003) define e-learning by considering, how, why and what aspects of e-learning take place. The definition identifies with: (a) the manner in which the course

is digitised for storage purposes; (b) the course content and the ways to help people learn it; and (c) assisting learners to achieve educational goals or helping organisations build skills relative to improved job performance (Clark & Mayer, 2003).

The White Paper on e-Education (Department of Education, 2004) highlights e-education as synonymous with the term e-learning in the South African context. This definition is developed to draw on Information Communication Technology (ICT) to accomplish the national education goals for the interaction of learners, teachers and specialised support services. The aim is to cultivate a platform for learning and to enable learners and teachers improved access to updated educational content based on learning and technology principles. Aside from the latter aim of developing and improving computer and technological skills, the definition places the e-education transition amid the urgent global need to strategically improve: (a) education, (b) ICT resources in the country and learning support, (c) education planning and (d) assessments. The e-Education White Paper (Dept. of Education, 2004: 14) defines e-education as:

“The ability to: apply ICT skills to access, analyse, evaluate, integrate, present and communicate information; create knowledge and new information by adapting, applying, designing, inventing and authoring information and function in a knowledge society by using appropriate technology and mastering communication and collaboration skills.”

In addition, Khan (2005, 2010), reiterates that e-learning is seen as a modern method to deliver carefully designed, learner-centred systems that encourage interaction and enable learning. In particular, the use of digital technologies and learning resources are especially suited to dispersed learning environments (Khan, 2005). In other words, it allows any learner to access the system from anywhere, irrespective of geographical location or demographics, when required. By this definition, e-learning is an inventive method for providing and delivering suitably designed, interactive learning systems based on learner needs.

Koohang & Harman (2005), on the other hand, defines e-learning as delivering education through different electronic mediums that consists of actions applicable to appropriate instructional design to incorporate key learning theories and principles to achieve the objectives of e-learning (Koohang & Harman, 2005).

However, Veerasamy (2010) states that e-learning terminology covers more than online learning, virtual learning, distributed learning, networked or web-based learning. There is an understanding that the term 'electronic' incorporates all educational activities that are carried out by individuals or groups working online or offline via networked or stand-alone computers and other electronic devices (Veerasamy, 2010).

According to the American Society for Training and Development (2011), e-learning is defined as:

[E]lectronic learning covering a wide set of applications and processes, such as web-based learning, computer-based learning, virtual classrooms, and digital collaboration. It includes the delivery of content via the internet, intranet/extranet (LAN/WAN), audio and videotape, satellite broadcast, interactive CD and CD-Rom.

Consequently this definition considers e-learning to be anything electronic and internet-based and focuses on learning delivery methods. The electronic-based approach holds that the age of the basic computer and internet technologies are relevant to learning as learners and stakeholders are continuously developing skills over time (ASTD, 2011).

A recent study by Sangra, *et al.*, (2012:4) presents a preliminary definition of e-learning as:

[A]n approach to teaching and learning, representing all or part of the educational model applied that is based on the use of electronic media and devices as tools for improving access to training, communication and interaction that facilitates the adoption of new way of understanding and developing learning.

This definition of e-learning contains a broad perspective of elements of technology, a delivery system and a communication and educational paradigm that relates to an educational model and delves into the adoption of an innovative manner in which learning is developed and understood.

As can be seen, the literature presents different elements for an interpretation of e-learning for this study. Distinct terms are used to define e-learning such as: technology, knowledge focus, learning, electronic and means of communicating learning. Table 2-1 (below), is a summary that reflects a summary of the referenced definitions with each researcher's identified areas of focus.

<b>Table 2-1 Summary of e-learning definitions (Summarised by the author)</b>			
<b>References</b>	<b>Represents learning needs</b>	<b>Technology focus</b>	<b>Knowledge focus</b>
Rosenberg (2001)	Not specifically addressed learning needs	Internet enabled and networked Distributed solutions	Improve knowledge and performance
Gunasekaran <i>et al.</i> , (2002)	Not specifically addressed learning needs	Internet enabled and updates according to changes	Not specifically addressed a knowledge focus
Waight <i>et al.</i> , (2002)	Inclusive of learning and teaching	Not solely independent of Internet and electronic mediums	Addresses a knowledge focus
Clark & Mayer (2003)	Focus on learner and education goals	Maintains a technology focus	Focus on course content
White Paper on e-Education (2004)	Encourages learner interaction and education goals	Appropriate technology platform to improve access	Addresses a knowledge focus
Zhang <i>et al.</i> , (2004)	Not specifically addresses learning needs	Computer networks and improve access to remote users	Apply to remote users
Khan (2005)	Stresses learner needs	Accessible technology and continuous improvements	Addresses a knowledge focus
Koohang & Harman (2005)	Maintains a learner focus	Maintains a technology focus	Addresses a knowledge focus

<b>Table 2-1 Summary of e-learning definitions (Summarised by the author)</b>			
<b>References</b>	<b>Represents learning needs</b>	<b>Technology focus</b>	<b>Knowledge focus</b>
Veerasamy (2010)	Not specifically addresses learning needs	Electronic/ offline devices / Internet	Not specifically addresses a knowledge focus
ASTD's learning circuits (2011)	Maintains a learner focus	Internet / electronic enabled	Not specifically addresses a knowledge focus
Sangra <i>et al.</i> , (2012)	Defines e-learning as an approach to learning	Inclusive of electronic media, devices and tools to improve access to training and communication	Acknowledges the facilitation of new ways of understanding and developing learning

The key terms in the analysis to interpret the e-learning definitions in the literature are as follows:

- **Learning:** The reference to the term “learning” as a focal point is present in 64% of the definitions in this study. This highlights the need to meet educational goals in two definitions which shows signs of using planning to improve learning.
- **Technology:** There is a 100% consensus that the technological aspects of e-learning communication, either through the internet, intranet, offline devices, stand-alone or networked solutions is necessary. The use of technology for learning presents a commonality among the definitions in Table 2-1 above. Koohang & Harman (2005) further establish that there is a need for pedagogy principles, instructional design, learning theories and principles to be incorporated into e-learning objectives.
- **Knowledge:** Of the references under consideration in Table 2-1 above, 73% of the definitions (namely Khan, 2005; Koohang & Harman, 2005; Rosenberg, 2001; Waight *et al.*, 2002; White Paper on e-Education, 2004 and Zhang *et al.*, 2004) explain the need to improve knowledge and performance and focus on remote learners and educational course content (Clark & Mayer, 2003). Other

factors in this category include the need for e-learning to be accessible by learners to apply, acquire, create and maintain the knowledge that is learnt.

Taking into consideration the above interpretations of e-learning, the focus on learning is evident in 64% of the definitions whereas the core purpose of e-learning is to enhance learning. According to Govindasamy (2002), e-learning is another method of learning and enhancement of pedagogy principles is necessary to keep pace with technological changes as the options for utilising technology changes and vendors deliberately exclude the integration of pedagogy. The references highlight the importance and value of learning and technology as a key element and focuses on the type of instruction methodologies, electronic medium and methods of delivery. Hence, there is a need for e-learning definitions to take into consideration the shift in focus from technology to learning and pedagogy. Such an inclusive definition of e-learning helps define suitable pedagogic e-learning frameworks and presents key elements for effective design, development and implementation of e-learning systems (Sangra *et al.*, 2012).

In terms of the literature, it is evident that an e-learning definition incorporates elements of learning and the transfer of skills through technological tools. The above study bears testimony to a huge range of definitions of e-learning and confusion sets in as to the best way to define the e-learning concept.

Therefore, the proposed definition for e-learning is:

**E-learning is an electronic learning process to facilitate and maintain the acquisition of knowledge and transmission of learning content to learners through an accessible, pedagogical technology tool.**

Based on the above definition, this study emphasises the relevance of the learning, pedagogical and technological themes in e-learning. The alignment of learning, pedagogy and technology ensures the continuity and monitoring of learning through an acceptable medium. The role of technology as an enabler for an e-learning system to achieve learning goals is discussed in the next section (Section 2.4) as is the extant e-

learning frameworks and pedagogical elements (Section 2.5) which is presented in the framework proposal in Chapter 4.

All the definitions of e-learning (Section 2.3.2) acknowledge that technology facilitates learning and promotes growth and training. Yet learning is no longer primarily an individual experience, but now embraces the changes in global trends, government policies, strategies and learning behavior (Reiser & Dempsey, 2002). In addition, e-learning extends beyond the boundaries of traditional teaching methods and in some circumstances-the effects on learning in e-learning environments are negative.

### **2.3.3 Conclusion to Research Question 1**

In sum, the above discussion in Section 2.3 reveal that, there is no appropriate definition of e-learning to encompass all learning elements completely and the range of definitions of e-learning stress require more emphasis on learning than what is currently evident. Therefore, the study proposes a definition of e-learning to address the lack of a more learner-centered definition of e-learning.

The following Section 2.4 investigates the role of technology in a learning environment and discusses the instructional methodologies essential to e-learning systems.

## **2.4 RESEARCH QUESTION 2**

<b>What is the role and impact of technology in the e-learning environment?</b>
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### **2.4.1 Introduction to Research Question 2**

The literature addresses Research Question 1 in Section 2.3 and derives a suitable e-learning definition for this study that is dependent on pedagogy, learning and technology. Its relevance to this study is to consider the most suitable instructional methodologies for technological transfer of learning content and curricula to learners.

The research indicates that there is no comprehensive e-learning definition and there is a lack of adherence to a structured approach (Sangra *et al.*, 2012). As the derived definition of this study is on the basis of the importance of learning, pedagogy and technology to pursue e-learning initiatives, an integrated approach to the e-learning framework is important to address these factors.

#### **2.4.2 Role of technology**

Since e-learning depends on the effective contribution of technology to satisfy pedagogy and teaching requirements, researchers maintain that the *effective* use of pedagogy and technology is therefore critical to e-learning systems. However, inappropriate uses of technologies, inadequate attention to pedagogy and ineffective instruction methods are evident (Siemens, 2005).

However, while it is often the case that ICT supports learning and teaching initiatives (Jochems *et al.*, 2004), questions as to how technology can be better implemented to effectively enhance learning is evident (Mason & Rennie, 2006; Warger & Dobbin, 2009). Evidently, the alignment of learning and technology requires an understanding of how technology and pedagogy can integrate seamlessly in the e-learning environment (Reiser & Dempsey, 2002), especially since the advancements in technology happen at a faster rate than pedagogical elements use them (Brown, 2003 and Spender, 2002).

Researchers (Brown & Voltz, 2005; Grabinger *et al.*, 2007; Oliver, 2005; Strommen & Lincoln, 1992; Warger & Dobbin, 2009) believe that enhancements in technology demonstrate new methods of e-learning, as opposed to conventional, traditional learning methods (Boettcher, 2007). Little (2001) warns that e-learning should not be dictated to by technology in the event that the value and principles of e-learning are lost. At first technology does not completely incorporate into learning programmes and although it enhances several areas of learning, the challenge lies in adequately positioning technology to achieve a learning advantage (Lippman, 2010). As a result, a sound understanding of tools, equipment, skills, knowledge and theory is necessary in

learning design (Steen, 2008). According to Strommen & Lincoln (1992) and Khan (2005), internet and digital technologies contribute to effective learning environments where technology integrates the exchange of information between learners, teachers, educational institutions, the workplace, online database, multimedia, technical and interactive sources. Undoubtedly, technology affects the elements of communication, culture and interaction between learners, instructors and institutions (Boettcher, 2007; Grabinger *et al.*, 2007; Lippman, 2010).

Research carried out on large- and small-scale educational institutions in West Virginia provides significant views on the effect of technology on education (Schacter, 1999). The study reveals that the computer-based instruction targets learner needs, styles, interests, and existing knowledge. There are reports that the computer-based instruction results in high user-satisfaction and learner motivation. Although learners feel that the access to technology is not sufficient and the role of teacher's sometimes inadequate, thereby limiting learning, they acknowledge that more learning is attainable in a short period of time. Learners feel that computer based instruction increases: (a) reasoning and problem-solving; (b) co-operation with instructors by learners in groups; and (c) reduced traditional teaching methods. Overall, the technological solution also proves to be a cost-effective learning option. Although the computer-based instruction is not suitable to all areas of learning there is a strong inclination to use the technology to achieve learning objectives. However, the lack of clearly outlined learning objectives, is a stumbling block to learning and the requirements of technology to fully deliver learning is not properly established (Schacter, 1999).

Technology, reported by other researchers also plays a significant role in the following areas:

- **Activities:** The models by Alessi & Trollip (2001); Jochems *et al.*, (2004) and research by Merrill, Barclay & van Schaak (2008) highlight the use of learning activities as an effective way to ascertain if learning is taking place. ICT provides practical functions for the completion of activities by enabling practice on tasks or lessons and testing and assessing whether the content is being learnt. The activities are essential to gauge if learners understand the content and instructions. Technology makes provision

for learners to complete and repeat the activities and provide comments, hints or guidance as to how tasks can be completed.

Activities further encourage learners to retain knowledge by performing repetitive actions (Mason & Rennie, 2006) and supports learning practice either verbally or non-verbally (Alessi & Trollip, 2001). Further research by Alessi & Trollip (2001) implies that activities within the learner-centred approach are designed around learner capabilities in collaboration with instructional methodologies.

- **Administrative support:** Researchers identify that technology extends into organizational and individual functions to ease the administrative burdens of teaching, learning and research (Reiser & Dempsey, 2002; Sun, Cheng & Finger, 2009; Department of Education (SA) White Paper on e-Education, 2004). The use of e-systems for management and administration are effective to capture and store information that pertains to learner interventions, progress on curriculums, and maintain records for statistical purposes. The systems further ensure: (a) quality and reliability of the input of data; (b) determines the outputs of reporting progress; and (c) monitors and evaluates learner progress. The interactive nature of the automation of the administrative learning process realises further benefits through time-saving, improvement in accuracy, increase quality of reporting, and the provision of up-to-date information. In addition, the education sector shows considerable interest in the increase of efficiency and effectiveness of instructors' management and administrative functions through the introduction of electronic systems to ease the administrative burden and structure time for learning and teaching (Dept. of Education (SA) White Paper on e-Education, 2004).

- **Feedback and assessment tools:** The role of technology in activities and electronic systems make provision to administer assessments, evaluation and feedback and to ascertain whether objectives during activities were achievable. Researchers find the review feedback mechanisms are an effective method to: (a) guide the learner to identify the problem areas during learning (Merrill, 2002); (b) make provision for peer comments; (c) ascertain the various levels of understanding or skills that are used in to

achieve targets (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, Palincsar, 1991); and (d) enhance the quality of tasks (Jochems *et al.*, 2004).

In addition, some ICT assessment tools are functional and flexible to provide immediate analysis and assesses whether learner needs are met and provides comparisons and feedback on tasks and learning achievements in a confidential manner (Mason & Rennie, 2006).

Assessment and feedback tools enhance learning and allow learners to relate problem-solving skills to everyday life through an analysis of their knowledge and skill (Merrill, 2002). Although assessment results increase or lower learner motivation, researchers believe that assessment tests are an accurate indicator of active learning that is recorded. Computer generated or on-line testing also increases the quality of testing through accurate mediums and welcomes a move away from traditional testing and marking (Alessi & Trollip, 2001). The timeliness of evaluation and the assessment and authenticity of learning content is critical to learning (Jochems *et al.*, 2004: Department of Education (SA), White Paper on e-Education, 2004).

- **Access and availability to information:** Technology increases the provision, access and availability of educational content among learners and teachers (Alessi & Trollip, 2001; Alexander, 2001; Jochems *et al.*, 2004; Khan, 2005; Riel & Fulton, 2001; Reiser & Dempsey, 2002; Schacter, 1999; Dept. of Education (SA) White Paper on e-Education, 2004). On-line and web-based learning increase the learners' access to information on already existing systems (Cheong, 2002). Learners can access learning content and share learning experiences through available web technologies and through technology realise the advantages of anywhere, anytime, flexible learning (Hui, 2007; Khan, 2005).

- **Instructional methodologies:** Instructional design focuses on designing methods of instruction through technology with a learner-centred approach (Reiser & Dempsey, 2002). It is necessary to consider instructional methodologies in this study as it relates directly to methodologies that affect the learning process. It ought to accommodate learner needs and be used to consider: (a) the practical aspects of

learning; (b) the possibilities of change and (c) the learner's unpredictable nature (Rieber, 1996; Siemens, 2005). Nam & Jackson (2007) recognise that design requires more focus on usable, accessible user-learning interfaces and includes a need to identify suitable learning interventions to benefit the learner. The focus considers learners' diverse, individual learning styles and cultures, and a design to deliver relevant and suitable instructions - particularly for revision and evaluation. To this end, the purpose of effective instruction through multimedia technology aims to address diverse learning needs (Alessi & Trollip, 2001).

Alessi & Trollip (2001) note the following instructional methodologies that play an important role to facilitate learning as per learner requirements:

- **Tutorials:** This type of instructional methodology presents information and guides the learner in the first stages of acquiring knowledge. Tutorials include: (a) instructional programmes to present information; (b) demonstrate skills to learners via the information given; (c) review complete tasks; and (d) evaluation and assessment (Alessi & Trollip, 2001). Questions in tutorials assess the progression of learning, for example, graphics, true/false questions or matching. The strategic position of the questions and feedback mechanisms to assess learning determines whether the learner remains motivated and, moreover, understands what is being learnt. The sequence of activities and learners' comfort levels affect learning behavior. Importance is on the skills achievable through demonstration and practical learning (Alessi & Trollip, 2001).
- **Hypermedia technologies:** These programmes consist of a database accessible via features, links and navigation methods to facilitate learning and identify requirements to satisfy learning needs (Alessi & Trollip, 2001; Khan, 2005). Hypermedia design exposes learners to access larger collections of electronic information and affect content, formats, context, search, updates, learning support, and learner principles to achieve good quality design decisions (Alessi & Trollip, 2001). However, the methods that facilitate navigation are: (a) poor structure; (b) requires more visual stimulation to the learner and (c) contains either too many or too few links to enable learners to access information. Furthermore, learners gain access to a vast

amount of available information that is unsuitable for particular age groups (Alessi & Trollip, 2001; Khan, 2005).

Pedagogy needs determine the format and design of hypermedia programmes. The size and structure of the database affects the navigation controls where more content requires additional navigation and the learner needs to maintain added comprehension, motivation and memory to aid learning. The resolution of a programme determines the learner's focus and flexibility: where small resolution promotes easy access and navigation, a larger resolution, on the other hand, makes navigation easier to zoom and adjust the view to suit learner needs (Alessi & Trollip, 2001). The features increase motivation and encode, retain and use knowledge in opposition to the learning strategies that depend on the learners' initiative to improve awareness of learning, comprehension and learner orientation (Alessi & Trollip, 2001).

- **Drills:** Drills are a method to gauge the content that is learnt through teaching when a learner continues to practice on the same tasks. The aim is to establish the preservation of knowledge and fluency to enable the learner to master the content of the training material (Alessi & Trollip, 2001). The use of drills in computer practice is not very common but is an area with great potential to enhance learning and identify learning gaps (Jochems *et al.*, 2004). The graphics in drills attract the attention of young and older learners particularly during feedback, comprehension and to enhance motivation. Drills constitute varying levels of difficulty and are an effective way to ease the learner to answer the higher levels of questions. The application response time and the learner's pace to complete tasks affect the learner's interaction with the system (Alessi & Trollip, 2001).

- **Simulation:** This is an effective way to present the actual events in a safe, constrained technological environment. It purposively guides and assists the learner to practice real-life situations and assesses knowledge and skills to allow learner participation and experience without risk (Alessi & Trollip, 2001; Jochems *et al.*, 2004; Mason & Rennie, 2006; Rieber, 1996). In combination with other methodologies simulation presents interactive methods which assist to clarify complex or difficult concepts and enables learners to achieve or exemplify specific objectives (Clark &

Mayer, 2003; Mason & Rennie, 2006; Rieber, 1996). The aim of simulation is specifically to: (a) address a particular objective; (b) gain knowledge; (c) solve problems; (d) explore; (e) test; (f) learn; and (g) understand characteristics of a phenomenon (Alessi & Trollip, 2001; Rieber, 1996). The research highlights the perceived control of a learner in a simulation that affects the learners' response to that system, enhances recall and recognition, allows the facilitator the chance to briefly identify and analyse learner characteristics and principles of knowledge, and encourages lateral thinking and problem solving. The use of simulation in education also enables learners to: (a) monitor results of their actions through feedback; (b) establish how they themselves represent and use knowledge; and (c) is dependent on the learner's age, gender, knowledge, behavioural abilities, learning style, and the desire to learn (Alessi & Trollip, 2001).

Jochems *et al.*, (2004) maintains that simulation maximizes learning and instruction. An effective complex design programme is able to encapsulate a thorough knowledge of the learning content to simulate the scenario and implement a model. Furthermore, simulations can allow a high level of learner or programme control by giving designers more options and flexibility than other methods and vary on the basis of learning requirements (Jochems *et al.*, 2004).

- **Games:** Games add educational value to acquire knowledge and improve learning skills and range from simple to complex interventions to make learning fun for all ages, attract learner's attention and maintain higher levels of learning achievements (Boettcher, 2007; Mason & Rennie, 2006; Rieber, 1996; Reiser & Dempsey, 2002). Certain games provide timely, visual, textual, or audio feedback to measure achievements of the game against outcomes and improve the process of practice rather than learning from concepts in text (Alessi & Trollip, 2001; Clark & Mayer, 2003; Mason & Rennie, 2006; Rieber, 1996; Reiser & Dempsey, 2002). Studies show that the good design of a game promotes interactivity, attracts the learner's attention and maintains higher levels of achievement that develops skills and learning (Reiser & Dempsey, 2002). Games generate critical thinking, problem-solving skills and fun learning activities through active learner participation. Games stimulate learning and acquire

knowledge through a structured approach and maintain a fair amount of challenge through various game levels (Rieber, 1996).

- **Web-based training:** Web-based training engages various methodologies through a central location and enables the provision of learning to target audiences of different ages, interests, and varying educational and organizational requirements (Alessi & Trollip, 2001). The advantages of web-based training are: convenient access to learning material; access to accurate content; enable communication between learners and teachers; and encourage learner support over varying distances to include the three-fold function of assessments, tests and evaluation. From a design perspective, web-based training is capable to integrate existing technologies with ease (Alessi & Trollip, 2001). However, the downside is thought to be the lack of technological knowledge by learners and connectivity problems that affect the continuity of web-based training. Active learner interaction on websites is found to be inadequate where functions such as navigation, illustrations, media, video, text, sound, and movies are provided when the system downtime is high (Alessi & Trollip, 2001).

### ***2.4.3 Conclusion to Research Question 2***

The literature discussion in Section 2.4 highlights the role and impact of technology on learning. The definition derived in the previous Section 2.3 identifies pedagogy, learning and technology as central to designing e-learning systems. Section 2.4, then presents technology as a crucial medium to support pedagogy, learning and teaching and attempts to corroborate that streamlining the synergy between learning and technology significantly increases learning effectiveness, guides the structural effects of technology and benefits stakeholders.

In summary of the discussion above, adequate planning is required to establish clear objectives and to maintain and monitor a structured approach to facilitate learning through technology. In an exploration of Research Question 2, the technology medium is found to be an important consideration in the e-learning framework to support and streamline learning. What the literature revealed is that the selection of technology

coupled with instructional methodologies is dependent on the formulation of goals, objectives and outcomes in line with learning needs. The role of technology is to be further accommodated in Chapter 4 through the proposed framework as the selection of technology further serves an important aspect of the design phase, after the key learning requirements for an e-learning system is established.

## **2.5 RESEARCH QUESTION 3**

**What frameworks and pedagogy principles currently exist to guide e-learning systems design and development?**

### ***2.5.1 Introduction to Research Question 3***

In arriving at this question this study establishes that:

- Learners, pedagogy and technology are considered as important elements in e-learning (Section 2.3).
- The role of electronic technology impacts learning and the future effects of this technology on learning are considered in the design and development of e-learning systems (Section 2.4).

This section now investigates the extant e-learning frameworks and pedagogical principles for effective design and development. The research considers the study into the e-learning frameworks because e-learning systems are guided by them. Several factors contribute to the creation of a meaningful environment that accommodates diverse learning styles, learning needs and dimensions of an e-learning environment that needs exploration (Khan, 2005). Frameworks and components exist with an e-learning focus, which describe key elements that influence e-learning (Oliver, 2005). The literature study undertaken identifies extant e-learning frameworks that contribute to the development of the pedagogical framework for e-learning for this study. The literature under investigation determines the various perspectives with the emphasis on pedagogic principles, structure and systematic guidance.

The literature in this section reviews five e-learning frameworks for the design and development of e-learning systems. This study further investigates these frameworks and models to understand and propose a suitable pedagogic e-learning framework in Chapter 4 that incorporates the pedagogical principles.

The extant frameworks under discussion include:

- A Technology-Enhanced Learning (TEL) authoring model (Huang *et al.*, 2008) in Section 2.5.3 and summarised in Table 2-2.
- The Dick & Carey instructional model (Dick *et al.*, 2005) in Section 2.5.4 and summarised in Table 2-3.
- The e-learning P3 model (Khan, 2004) in Section 2.5.5 and summarised in Table 2-4.
- Khan's eight dimensional e-learning framework (Khan, 2001) in Section 2.5.6 and summarised in Table 2-5.
- The Analysis, Design, Development, Implementation and Evaluation (ADDIE) model (Clark, 1995) in Section 2.5.7 and summarised in Table 2-6.

### **2.5.2 Defining an e-learning framework**

The literature references for the third research question, requires an understanding of an e-learning framework (Herrington & Oliver, 2000). An e-learning framework provides overall guidance and support to any learning type and teaching style in any classroom or online learning environment (Kuchi *et al.*, 2003). According to Khan (1997) and Oliver (2005) the e-learning frameworks and components exist with the focus on describing essential elements to influence e-learning outcomes with other factors in order to create a meaningful learning environment. Hence an e-learning framework for the purpose of this study is to provide for components, pedagogy principles and learning factors to achieve positive learning outcomes in e-learning systems. Therefore, this

study analyses the following extant frameworks to identify contributing pedagogic principles, learning factors and components for the proposed e-learning framework.

### **2.5.3 Technology Enhanced Learning (TEL) Authoring Model**

The technology enhanced model focuses on e-learning systems design from a technology perspective. TEL recognises that the contributions made to Information Communication Technology (ICT) stem from its roots in computer-based training (CBT) and that TEL is the ideal solution for meeting learning needs. The discussions in the literature focus on the applications of relevant technologies for learner-centered learning and the ease of accessibility to all learners irrespective of age, gender and social status (Huang *et al.*, 2008).

Huang *et al.*, (2008) outlines a framework for TEL solutions based on best practices, existing TEL models, technologies and the essential elements, based on the TEL Authoring Model. The advantage of the framework was that it was able to include any type of learning content that was delivered electronically and via computer-based training (CBT). Although the name of the framework itself (TEL) specifically entails the focus on technology, it gives significant attention to pedagogical elements as well, such as: needs analysis, outline of learning objectives, learning styles, authored learning segment, standards, and the course availability to the user. Through the TEL framework there is yet substantial focus on sufficient planning and detailed needs analysis. Given that the framework focuses on a technological learning solution, pedagogy requirements and planning stages requires more attention in this regard. A summary of the model is presented in Table 2-2.

<b>Table 2-2: Technology Enhanced Learning Model (TEL) (Huang et al., 2008) (Summarised by the author)</b>	
<b>Stages</b>	<b>Description</b>
<ul style="list-style-type: none"> <li>• Training needs analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Offers solutions in meeting learning needs.</li> </ul>

<b>Table 2-2: Technology Enhanced Learning Model (TEL) (Huang et al., 2008) (Summarised by the author)</b>	
<b>Stages</b>	<b>Description</b>
<ul style="list-style-type: none"> <li>• Learning objectives</li> </ul>	<ul style="list-style-type: none"> <li>• Identify learning requirements</li> </ul>
<ul style="list-style-type: none"> <li>• Learning objects presented according to learning styles</li> </ul>	<ul style="list-style-type: none"> <li>• The need arose to discuss the applications of relevant technologies for “user-centered” learning.</li> <li>• Aims at learning full use of the system</li> </ul>
<ul style="list-style-type: none"> <li>• Course generation</li> </ul>	<ul style="list-style-type: none"> <li>• Focuses on ease of accessible content to all learners for up to date content.</li> <li>• Application of technologies for user-centered learning where TEL offers a media rich tool</li> </ul>
<ul style="list-style-type: none"> <li>• Learning Object Repository (LO)</li> </ul>	<ul style="list-style-type: none"> <li>• Framework outline based on best practices, existing TEL models and technologies, for example, learning content management and reusable learning objects.</li> </ul>

#### **2.5.4 The Dick & Carey Instructional Design model**

The Dick & Carey Instructional Design model, by Dick *et al.*, (2005) provides a systematic, interrelated view of instruction. The model identifies a dynamic relationship between context, content, learning, instruction and role players in order to achieve desired learning outcomes. This model is therefore relevant to this study to synchronise these factors where improper planning and poor coordination is a large contributing factor to low satisfaction rates. A summary of the model is presented in Table 2-3.

<b>Table 2-3: Steps in the Dick &amp; Carey model (Dick et al., 2005) (Summarised by the author)</b>	
<b>Steps</b>	<b>Description</b>
<b>Step 1: Identify instructional goals</b>	<ul style="list-style-type: none"> <li>• Outline specific instructional goals to establish the desirable outcome and establish a difference between instructional goals and needs analysis.</li> </ul>

<b>Table 2-3: Steps in the Dick &amp; Carey model (Dick et al., 2005)</b> <b>(Summarised by the author)</b>	
<b>Step 2: Conduct instructional analysis and identify entry behaviors</b>	<ul style="list-style-type: none"> <li>• Identify the knowledge and skills the learner needs to acquire to reach a goal. Displays all steps diagrammatically through instructional analysis.</li> <li>• Analyse target audience and learners. Establish behaviour and prior experience based on tasks; information-processing analysis and learning-task analysis.</li> <li>• Identify the entry behaviour to determine skills to complete tasks. Includes intellectual, verbal skills and personality traits.</li> </ul>
<b>Step 3: Write performance objectives</b>	<ul style="list-style-type: none"> <li>• Identify performance objectives based on Steps 1 and 2 to detail needs, goals and specific objectives. These are the means through which the skills in the instructional analysis translate into complete descriptions of what students are able to do after completing the instruction.</li> <li>• Step 3 identifies if the instruction relates to the identified goals and conditions of learning.</li> </ul>
<b>Step 4: Develop criterion-referenced test items</b>	<ul style="list-style-type: none"> <li>• This step establishes whether a learner possesses the requirements to learn a new skill.</li> <li>• The criteria created for the performance objectives determines the type of test items employed in the system.</li> <li>• This step establishes if the objectives are achieved and tests if the learner acquires the desired skill.</li> <li>• The performance measures are determined before developing lesson plans and instructional material.</li> </ul>
<b>Step 5: Develop instructional strategy</b>	<ul style="list-style-type: none"> <li>• Instructional strategy determines the sequencing and organising of the information and determines how it is delivered.</li> <li>• This step details the implementation plan for learning, concentrating on the activities; content presentation; developing learner participation; testing and follow-through activities.</li> <li>• The purpose of this step outlines how the instructional activities aim to achieve the required objectives.</li> </ul>
<b>Step 6: Develop and select instructional materials</b>	<ul style="list-style-type: none"> <li>• The development of material incorporates multimedia, learning manuals; instructions; tests and an instructor's manual. Practice and feedback is essential where the best selected technology or medium is selected to: <ul style="list-style-type: none"> <li>➤ present the materials</li> <li>➤ monitor practice and feedback</li> <li>➤ evaluate</li> <li>➤ guide students to the next activity whether it is remedial, enrichment, or the next lesson.</li> </ul> </li> </ul>
<b>Step 7: Develop and conduct formative evaluation</b>	<ul style="list-style-type: none"> <li>• Formative evaluation involves information gathering which may be used to increase the efficiency of the instruction</li> <li>• The revision of the instruction attains clarity, tests assumptions, reviews, assesses impact and feasibility.</li> </ul>

<b>Table 2-3: Steps in the Dick &amp; Carey model (Dick et al., 2005)</b> <b>(Summarised by the author)</b>	
<b>Step 8:</b> <b>Design and conduct summative evaluation</b>	<ul style="list-style-type: none"> <li>• In the last step, various established evaluation methods enables data collection.</li> <li>• A revision of instruction is also conducted after Steps 4, 7 and 8.</li> </ul>

The model is effective in designing instruction as stakeholder designers play a vital role to develop relevant, feasible learning systems that satisfy all learning objectives. This model, therefore, provides relevant insight and contribution towards an all-inclusive e-learning framework.

### **2.5.5 The e-learning P3 model**

The e-learning P3 Model provides more detail on the stages of the e-learning process, the purpose and outputs of role players, namely directors; project managers; research and design coordinators and instructional designers (Khan, 2004). The activities involve the project teams in the output of a project plan place relative importance on pedagogy. The aim is to ensure that role players maintain pedagogical features according to the project plan and so maintain learner requirements as a focal point. The stages of the e-learning process are summarised in Table 2-4 below:

<b>Table 2-4: The stages of the e-learning P3 model (Khan, 2004)</b> <b>(Summarised by the author)</b>	
<b>Stages of e-learning</b>	<b>Description</b>
1. Planning	<ul style="list-style-type: none"> <li>• Develop project plan (including pedagogy, timeframes and finance)</li> <li>• Assign detailed roles/responsibilities adhering to the project plan</li> <li>• Guide the stages of the entire process through to completion</li> <li>• The project plan is key, outlining guidelines for the e-learning environment</li> </ul>

<b>Table 2-4: The stages of the e-learning P3 model (Khan, 2004)</b> <b>(Summarised by the author)</b>	
<b>Stages of e-learning</b>	<b>Description</b>
2. Design	<ul style="list-style-type: none"> <li>• Design course content and review in line with pedagogical elements and learner needs.</li> <li>• Select an appropriate delivery method based on learner needs.</li> <li>• Throughout this stage, role players including instructional designers, specialists, researchers and design coordinators review content.</li> <li>• Instructional designers and interface designers play an important role to incorporate learning content and presentation.</li> <li>• Design evaluation functions and produce a storyboard as an output for this stage.</li> </ul>
3. Production	<ul style="list-style-type: none"> <li>• Create course material and active communication</li> <li>• Pilot the system and receive feedback from a selection of demographically dispersed learners.</li> </ul>
4. Evaluation	<ul style="list-style-type: none"> <li>• Consists of formative, summative and ongoing evaluation: <ul style="list-style-type: none"> <li>➢ Formative: evaluate and change the system during development.</li> <li>➢ Summative: constitutes the final assessment of the product.</li> <li>➢ Feedback from pilot testing also forms part of evaluation and possible redesign.</li> <li>➢ Learner's feedback is crucial in this stage and the approved course material is distributed to target groups.</li> </ul> </li> <li>• Revise course material an output for this stage.</li> </ul>
5. Delivery and maintenance	<ul style="list-style-type: none"> <li>• Update and provide course material in a secure environment</li> <li>• Role players responsible for maintenance of the system are active in the e-learning environment.</li> <li>• Provide ongoing system and technical support to learners.</li> </ul>
6. Instruction	<ul style="list-style-type: none"> <li>• The instruction team delivers the final learning product through the most suitable method of instruction.</li> <li>• Maintain support throughout the process and address queries by learners.</li> </ul>
7. Marketing	<ul style="list-style-type: none"> <li>• Consistent process to keep up-to-date with current learning trends.</li> <li>• Markets the e-learning products to maintain a competitive advantage to promote awareness to increase e-learning.</li> </ul>

The above view details the process of e-learning system design of the e-learning P3 model through each stage, and it is evident that the learning and pedagogical principles are factors in the model. It can be seen that adherence to learning needs through

pedagogical principles is a common responsibility by all role players and not the sole responsibility of a specific member of the project team. The model suggests that the design of this e-learning system in its entirety is a comprehensive process that concentrates on planning and learning requirements (Khan, 2004). Hence this model provides a positive contribution to the proposed model in terms of the pedagogy requirements.

### **2.5.6 Khan's eight dimensional e-learning framework**

Khan's (2005) eight dimensional e-learning framework intends to create a flexible, open, effective, and distributed learning environment to cater for a diversity of learners. Khan's research identifies eight dimensions or components to build and support an effective learning environment to structure learning (Khan, 1997; 2001; 2005). These components include: (1) institutional; (2) pedagogical; (3) technological interface design; (4) design interface; (5) evaluation; (6) management; (7) resource support; and (8) ethical considerations which are random and not as steps in the framework. Each component consists of sub-components that further detail the focus areas of the e-learning environment. The components generate many questions during the planning and design phases where dimensions of e-learning impact on the design of e-learning systems (Khan, 2001). The following Table 2-5 below summarises the features of the eight dimensions in Khan's (2001) framework. The features provide direction and control during the design, development, delivery and evaluation of learning environments. The framework further encourages flexibility and accessibility of learning content during learning (Khan, 2001; Khan, 2005).

<b>Table 2-5: Khan's eight dimensional framework (Khan, 1997; 2001; 2005; 2010)</b>	
<b>(Summarised by the author)</b>	
<b>Dimensions</b>	<b>Features</b>
1. Institutional	<ul style="list-style-type: none"> <li>• Pertains to administrative and academic affairs and student services related to e-learning.</li> </ul>

<b>Table 2-5: Khan's eight dimensional framework (Khan, 1997; 2001; 2005; 2010)</b>	
<b>(Summarised by the author)</b>	
<b>Dimensions</b>	<b>Features</b>
2. Pedagogical	<ul style="list-style-type: none"> <li>• Refers to teaching and learning</li> <li>• Addresses content, audience, goal and media analysis, design approach, organisation and methods, and strategies of e-learning environments.</li> </ul>
3. Technological interface design	<ul style="list-style-type: none"> <li>• Examines issues centering on technology infrastructure, planning, hardware and software</li> </ul>
4. Design Interface	<ul style="list-style-type: none"> <li>• Refers to the overall look and feel of e-learning programmes. Encompasses page and site design, content design, navigation, and usability testing.</li> </ul>
5. Evaluation	<ul style="list-style-type: none"> <li>• Includes both assessment and evaluation of learners, instruction and learning environment.</li> </ul>
6. Management	<ul style="list-style-type: none"> <li>• Refers to the maintenance of learning environments and distribution of information.</li> </ul>
7. Resource support	<ul style="list-style-type: none"> <li>• Examines online support and resources to foster meaningful learning environments.</li> </ul>
8. Ethical considerations	<ul style="list-style-type: none"> <li>• Social and political influence, cultural diversity, bias, geographical diversity, learner diversity, information accessibility, etiquette, and legal issues.</li> </ul>

Khan's framework focuses on analysis and investigation using components of the eight-dimensional framework, resources and technology in conjunction with instructional design principles. The flexibility of Khan's (2005) framework allows for its application to any scope of learning environment as long as proper planning is carried out and adequate instruction methodologies are selected (Khan, 2005).

Khan (2010) believes that this e-learning framework is effective as it focuses on learner support and adheres to a structured design process where emphasis is on analysis, design, evaluation, and implementation. The challenge lies in the transformation of learning curricula, policies and strategies. Khan maintains that this shift from traditional teaching to e-learning requires a change of mindset for instructors (Khan, 2010).

Khan's e-learning framework makes provision for learning irrespective of the scope of the learning requirements. Khan's (2010) e-learning framework is more user-friendly

were responses, feedback and enhanced requirements are essential to improve learning, design and the effectiveness of e-learning systems.

**2.5.7 The Analysis, Design, Development, Implementation and Evaluation (ADDIE) model**

The ADDIE model is an acronym for the main processes of analysis, design, development, implementation, and evaluation and stems from instructional design models (Clark, 1995). The model displays a generic, systematic framework to the instructional design process and gives insight into targeting specific technology for learner requirements. The aim is to provide designers with a structured approach where processes are an accurate interpretation as per system requirements. The model contains specific measurable outcomes under the guidance of a project manager to evaluate the milestones at the end of each phase (Reiser & Dempsey, 2002).

The factors that distinguish the ADDIE model from other models include:

- A defined project plan and project manager.
- A distinct roles and responsibilities assigned to role players.
- An evaluation team that is driven by the project manager and instructional designer and is evaluated at every stage.
- A design that caters for managing risks with the provision of rewards.

The model, as summarised by the author, is represented in phases in Table 2-6.

<b>Table 2-6: Phases in the ADDIE model (Clark, 1995)</b> <b>(Summarised by the author)</b>	
<b>Phases</b>	<b>Description</b>
1. Analysis	<ul style="list-style-type: none"> <li>• Constitutes planning and analysis where the analysis phase initiates the development of content.</li> <li>• Gathers information about the target audience to guide the design for the entire process, and establish: goals; objectives; outcomes; learning requirements; prior knowledge; current methods of delivery; limitations; and constraints.</li> </ul>

<b>Table 2-6: Phases in the ADDIE model (Clark, 1995)</b> <b>(Summarised by the author)</b>	
<b>Phases</b>	<b>Description</b>
	<ul style="list-style-type: none"> <li>• Instructional designers interpret information and present the findings, through accurate analysis.</li> <li>• No development or activity on a new phase is initiated until the pre-activity or phase is completed minimizing rework and saving cost.</li> <li>• The deliverable of one phase is input to the next phase and will not continue until the output of the phase is satisfactorily completed.</li> </ul>
2. Design	<ul style="list-style-type: none"> <li>• A plan or strategy is produced on outcomes where the focus is on design.</li> <li>• Guides how learning will be acquired to satisfy learning outcomes and objectives; organisation of content; instructional strategies; exercises; learning activities; presentation; delivery methods; and measurement of outcomes.</li> </ul>
3. Development	<ul style="list-style-type: none"> <li>• Involves the creation of activities and blueprints; the production of learning and content in a system based on the requirements formed in the design phase.</li> <li>• Based on the objectives and measurement tools detailed in the design phase, media, tools and processes are selected to create the learning material.</li> <li>• Learning material is collected and prepared for testing.</li> </ul>
4. Implementation	<ul style="list-style-type: none"> <li>• The implementation phase follows from development and presents the system to the stakeholders where a smooth transition of the system is desired.</li> <li>• The instructional designer is required to test all content and material for functionality, purpose and appropriateness.</li> </ul>
5. Evaluation	<ul style="list-style-type: none"> <li>• The ADDIE model contains checkpoints in each phase to evaluate the work completed to ensure the desired goals are achieved</li> <li>• Summative and formative assessments are conducted to measure achievements of course objectives and progress in the achievement of outlined goals</li> </ul>

Clark (1995) proposes the ADDIE model as a guide to structure the approach to design because the model is flexible and performs activities in each phase. Furthermore, the iterative nature of the model allows the instructional designer to continuously assess the elements for correctness and applicability and to revise or enhance the design.

### **2.5.8 A summary of e-learning frameworks and models**

As a summary of the above discussion, Table 2-7 offers a consolidated view on the frameworks presented above from Sections 2.5.3 to 2.5.7. All the frameworks depict

the components, stages and phases that constitute elements for design of e-learning systems. The summary of the components in Table 2-7 below and the elements from Section 2.5.9 to follow, will essentially contribute to the derivation of an e-learning framework in Chapter 4, as an output for this study.

The conclusion of this section is that although there are extant frameworks currently guiding e-learning systems design there is a lack of a consolidated framework of components and elements to resolve the overall lack of pedagogy in e-learning systems design and development. However, through the frameworks above, this study identifies that there are elements of importance in each framework to consolidate into one proposed pedagogic e-learning framework.

<b>Table 2-7: Summary of e-learning frameworks and models (Summarised by the author)</b>		
<b>Framework / Year</b>	<b>Description</b>	<b>Components</b>
Technology Enhanced Learning framework (TEL) Huang <i>et al.</i> , (2008)	<ul style="list-style-type: none"> <li>• Offers solutions in meeting learning needs.</li> <li>• Focuses on ease of accessibility to all learners.</li> <li>• The need arose to discuss the applications of relevant technologies for “user-centered” learning.</li> <li>• Framework outline based on best practices, existing TEL models and technologies, for example, learning content management and reusable learning objects.</li> </ul>	<ul style="list-style-type: none"> <li>• Training needs analysis</li> <li>• Learning objectives</li> <li>• Learning object repository</li> <li>• Learning objectives presented to learner according to learner style</li> <li>• Course generation</li> </ul>
The Dick & Carey instructional model Dick <i>et al.</i> , 2005	<ul style="list-style-type: none"> <li>• This model guides a systematic, interrelated view of instruction rather than isolated parts working together.</li> <li>• This model identifies the dynamic relationship between context, content, learning and instruction and role players in achieving the desired outcomes.</li> </ul>	<ul style="list-style-type: none"> <li>• Identify instructional goals</li> <li>• Conduct instructional analysis and identify entry behaviors</li> <li>• Write performance objectives and develop criterion-referenced test items</li> <li>• Develop instructional strategy and develop and select instructional materials</li> <li>• Develop and conduct formative and summative evaluation</li> </ul>

<b>Table 2-7: Summary of e-learning frameworks and models (Summarised by the author)</b>		
<b>Framework / Year</b>	<b>Description</b>	<b>Components</b>
The e-learning P3 model Khan, 2004	<ul style="list-style-type: none"> <li>• Details stages of the e-learning process.</li> <li>• The role players purposes are stipulated in line with the importance placed on pedagogy in the planning stage.</li> <li>• Addresses all activities in the process pertaining to the involvement of the project teams for the output of a project plan.</li> </ul>	<ul style="list-style-type: none"> <li>• Planning</li> <li>• Design</li> <li>• Production</li> <li>• Evaluation</li> <li>• Delivery and maintenance</li> <li>• Instruction</li> <li>• Marketing</li> </ul>
Khan's eight dimensional e-learning framework Khan, 2001	<ul style="list-style-type: none"> <li>• The framework details the focus areas of the e-learning environment</li> <li>• Components and subcomponents during planning or design phases of e-learning systems, dimensions of e-learning impact on the design of e-learning systems and at any instance the dimensions of e-learning would apply.</li> </ul>	<ul style="list-style-type: none"> <li>• Institutional</li> <li>• Pedagogical</li> <li>• Technological interface design</li> <li>• Evaluation</li> <li>• Management</li> <li>• Resource support</li> <li>• Ethical considerations</li> </ul>
The ADDIE model Clark, 1995	<ul style="list-style-type: none"> <li>• Displays a generic, systematic framework to the instructional design process.</li> <li>• Structured approach for effective and accurate processes.</li> <li>• The model guides learning process according to detailed measurable outcomes.</li> <li>• Project manager guides and evaluates milestones at the end of each phase.</li> </ul>	<ul style="list-style-type: none"> <li>• Analysis</li> <li>• Design</li> <li>• Development</li> <li>• Implementation</li> <li>• Evaluation</li> </ul>

The Section 2.5.9 to follow, details pedagogic elements which are needed for specific pedagogical requirements in the proposed e-learning framework in Chapter 4.

### **2.5.9 Pedagogic elements in an e-learning system**

The frameworks presented and summarised in Table 2-7 above presents an overview of the investigation of the author's contribution in the literature based on extant e-learning frameworks. To fully address Research Question 4 in this Section 2.5.9, this study

further researches the respective pedagogic elements or pedagogic principles, as sometimes referred to in other literature sources. The pedagogic elements serve to highlight the importance to maintain and acknowledge learner requirements through each of the dimensions in Chapter 4 when the pedagogic e-learning framework is proposed.

Over the years, the term pedagogy maintains its meaning of “leading or guiding to learn” (Beetham and Sharpe, 2013:1). Govindasamy (2002) believes that the pedagogical principles form the basis of every e-learning system and extends in order to accommodate for the changes in technology. Researchers offer general pedagogical principles, however the requirements of the learning context determines the relevance of specific pedagogical principles (Beetham & Sharpe, 2013).

The key pedagogic principles of e-learning according to Anderson & McCormick (2005) contribute to the development of effective e-learning systems. These principles indicate that pedagogy should: (a) match the learning curriculum based on clear objectives, content, activities and the nature of assessments; (b) be inclusive in terms of varying achievements and disabilities that can be accommodated through e-learning, social, ethnic groups and gender; (c) engage, educate and motivate learners; (d) justify the need for learning technologies and the need for e-learning; (e) enable effective learning through the use of varying approaches of the learning platform; (f) provide for formative assessments; (g) include valid, comprehensive, reliable summative assessments excluding emotional impact to the learner; (h) be open and accessible in design and consistent in matching the objectives, content, activities and assessments; (i) ensure transparency of e-learning; (j) ensure that technology solutions are cost effective, sustainable and justified. The aim to adhere to the pedagogic principles in the design and development of e-learning systems improve the learning experiences of learners in all e-learning environments. The advantage of the pedagogic principles is that they contribute to the development of pedagogic learning materials, resources and activities as the learner plays an active role in their learning process (Anderson & McCormick (2005).

In keeping with the pedagogic principles discussed above, the following pedagogic elements that form the building blocks for e-learning frameworks are present in the literature study by other researchers. The pedagogic elements include: assessment and feedback; content; contribution by instructors; culture; influence of technology; interactivity; learning principles; learning process; learning styles; planning; quality assurance; and user satisfaction. Chapter 4 details the inclusion of the pedagogy elements in the derivation of the pedagogic framework for the design and development of e-learning systems. The pedagogic elements are as follows:

- **Assessment and feedback:** The effects of a learning system are measurable through evaluations, formative, summative assessments and outcomes (Warger & Dobbin, 2009). An in-depth study by Ireland *et al.*, (2009) outlines the need for existing models, frameworks and tools to guide evaluation and assessment processes to monitor outcomes on learners for active learning and, identify learning areas of importance and develop knowledge, competencies and skills (Govindasamy, 2002; Grabinger *et al.*, 2007; Mason & Rennie, 2006; Naidu, 2006). An assessment-centred approach incorporates ongoing activities, continuous monitoring and feedback of learner progress, with the possibility of avoiding a once-off assessment at the end of the learning intervention (Brown & Voltz, 2005; Kuchi *et al.*, 2003; Naidu, 2006).
- **Feedback:** is a powerful method to express learner's assessments, instructor's ideas, activities, and interactions (Khan, 2005; Naidu, 2006) and reveal their past and present progress, experiences, and analyse knowledge to improve performance (Brown & Voltz, 2005; Haddad, 2003; Herrington & Oliver, 2000; Mason & Rennie, 2006; Merrill, 2002; Naidu, 2006). According to Naidu (2006) the relevance of learning interventions and its source of origin determines the feedback content. However the relevance of feedback mechanisms to specific instructional design methods does not receive significant attention and lacks any application design to target learner-centered design issues (Naidu, 2006; Nam & Jackson, 2007). There is need to address both learner needs and a set standard in global requirements to ensure authenticity of context and learner activities (Herrington & Oliver, 2000; Khan, 2005).

- **Content:** Content is the core factor in an e-learning system for the development and delivery of relevant, authentic courseware and to monitor the structure of courses in line with strategic objectives and curricula (Alexander, 2001; Boettcher, 2007; Brown & Voltz, 2005; Govindasamy, 2002; Merrill, 2002; Oliver, 2005). An e-learning design also focuses on preparing, designing and implementing appropriate content into logical structures for e-learning systems so that the accuracy of content in line with learning curricula is planned and incorporated into the design (Merrill, 2002; Warger & Dobbin, 2009; Wild, Griggs & Downing, 2002). This study recognises that it is essential to establish learning outcomes to determine learner engagement with course material and identify activities that construct knowledge, reflection, articulation and individual learner responsibility for learning (Oliver, 2005).

- **Contribution by instructors:** Instructors provide critical input to the design of e-learning systems particularly from a teaching perspective (Wild *et al.*, 2009). In the cycle of programme development, instructor's input targets course design and presentation of learning material to achieve learning objectives (Grabinger *et al.*, 2007; Hui, 2007 and Wild *et al.*, 2009). The instructors' role in furthering learning includes input into: design, support, feedback and assessment stages to help learners recognise the value of the content (Boettcher, 2007). Research indicates that traditional systems analysis and design methodologies are essential to take instructors' contributions into account to achieve instructional goals (Govindasamy, 2002 and Sun *et al.*, 2009). The research reflects a positive inclination towards addressing previous inefficiencies by the inclusion of the instructors' understanding of learners' needs (Qureshi *et al.*, 2011).

- **Culture:** Culture is crucial in an e-learning environment due to social standing, norms, rituals, and pressures of society (Boettcher, 2007; Mason & Rennie, 2006; Reiser & Dempsey, 2002). Khan (2001) and Warger & Dobbin (2009) believe that awareness of culture is a pertinent concern to ascertain the effects of outcomes-based education, new learning concepts and learning material. Further research reveals that, at different levels in society, the culture and learning varies within the learning environment (Boettcher, 2007; Grabinger *et al.*, 2007; Warger & Dobbin, 2009). Diverse

cultures continue to grow through interactions and learning experiences (Warger & Dobbin, 2009). This study recognises the element of culture as beneficial to address learning in target groups and to raise awareness of culture in the planning stage of the e-learning framework.

- **Interactivity:** Interactivity results in peers, teachers and mentors working together in a structured learning process (Boettcher, 2007; Grabinger *et al.*, 2007; Khan, 2005; Oliver, 2005, Pituch & Lee, 2006; Reiser & Dempsey, 2002; Sun *et al.*, 2009). Interactivity also means that learning within a context - promotes as a result of interaction between learners – support for a more receptive response to educational needs particularly as all the stakeholders in a learning environment need to be understood to be effective (Boettcher, 2007; Herrington & Oliver, 2000; Khan, 2005; Lippman, 2010; Warger & Dobbin, 2009). To this end, learners form part of an environment where knowledge is sustainable and promotes a positive atmosphere for learning (Mason & Rennie, 2006). In countries where opportunities permit, learner interaction exceeds traditional boundaries (Warger & Dobbin, 2009). As economic growth increases, learners are open to situations to enhance knowledge outside of the formal learning scenario (Warger & Dobbin, 2009, White Paper on e-Education, 2004). Researchers find from interactions with other learners and instructors, specifically when tasks were representative of situations that learners could relate to and understand derives additional value. However, researchers report lack of management and quality assurance where instructors cannot establish the value of learning or control the extent of interaction (Khan, 2005; Mason & Rennie, 2006). It is therefore imperative that the interaction of learning as an element requires careful planning to be effective.

- **Learning principles:** The target audience for e-learning systems comprises of individual learners of groups of learners (Boettcher, 2007). Alongside teachers and instructors, learners are dynamic participants in the learning process and importance is placed on learner-centred approaches that acknowledge the unique abilities of learners (Steen, 2008) and which engages learners to broaden their knowledge and increase their capability of problem solving skills (Grabinger *et al.*, 2007; Khan, 2005; Mason & Rennie, 2006; Merrill, 2002; Siemens, 2005). Added responsibility is on learners to be

accountable for their own learning progress, knowledge gathering and information sourcing processes (Warger & Dobbin, 2009). Researchers call for a learner-centred approach in design of environments to maximise e-learning support and communication with other learners and instructors (Khan, 2005; Wild *et al.*, 2009). Incorporating learning principles into an e-learning framework considers all factors that pertain to the learner.

Research reveals constructivist and instructivist arguments for computer programmes to use as tools to provide learning content and also to utilise as an administrative function to store learning, evaluation and assessment results (Alessi & Trollip, 2001). Constructivist principles aim to develop independent, self-reliant, confident learners to construct, maintain and grow their own learning (Mason & Rennie, 2006). The constructivist approach maintains that learners create or construct knowledge for themselves as learning progresses and focuses on a learner-centred rather than teacher-centered approach (Nam & Jackson, 2007). According to Nam & Jackson (2007) the learner-centred approach derives principles that recognise learning as an active process that encourages learner interaction and over time, learner's gain knowledge and their understanding of tasks improve. Furthermore, the learner's reflection, language and self expression particularly via on-line learning, emphasise the improvement on prior knowledge (Nam & Jackson, 2007). The learning principles highlight the context and representation of concepts that enhances memory during learning and achieves learning through practice and physical completion of tasks (Haddad, 2003).

- **Learning process:** The process of learning recognises guidance of learners through steps in tutorials that help structure their learning experience (Blumenfeld *et al.*, 1991). In the view of the knowledge-centred approach, it is evident that the learning process is ongoing and not a one-off, unrepeated approach. This view encompasses a process of constant learning, knowledge gain and dissemination of knowledge in other relevant areas of learning (Kuchi *et al.*, 2003). Merrill (2002) believes that learner participation recognises the learner as active in the learning process and reacts positively on completion of activities and shorter engagements of lecture sessions.

Thus the requirements to engage learners during the learning process enables learners to grow, acquire, relate, and build on knowledge and enhance recall, and recognition for a contribution to lifelong learning (Boettcher, 2007; Mason & Rennie, 2006). It is therefore imperative that designers take into account the understanding of the process of learning to cater for the requirements from the onset of system planning.

- **Learning styles:** Little (2001); Mason & Rennie (2006) and Qureshi *et al.*, (2011) maintain that learning styles and types of learning influence the e-learning design processes where learners control the pace and style according to their learning needs. The learning styles help to understand the dynamics in target groups and determine the levels at which to pitch learning, training material and assessments (Little, 2001; Qureshi *et al.*, 2011) The intention is learner-focused on inherent learner's skills, distinctive styles, character traits, and attitudes that influence the learning process (Boettcher, 2007; Kuchi *et al.*, 2003; Merrill, 2002). Therefore, the design of e-learning systems requires structure and a plan to incorporate diverse learner styles (Khan, 2005). In line with learning principles, learners exhibit diverse learning styles that require support from a range of problem-solving techniques and tools in use in learning environments (Boettcher, 2007; Brown & Voltz, 2005; Grabinger *et al.*, 2007; Khan, 2005; Mason & Rennie, 2006; Pituch & Lee, 2006). In some instances, it is suitable to adapt learning according to learning styles, but a new generation of learners, diverse learning styles, learning needs and learning methods are cause for systems to adjust accordingly (Qureshi *et al.*, 2011).

- **Planning:** In the light of research, the learning experiences and the increase in focus on what and how learning takes place requires that more responsibility is on establishing and planning the outcomes of learning (Boettcher, 2007; Grabinger *et al.*, 2007; Khan, 2005; Lippman, 2010; Mason & Rennie, 2006; Merrill, 2002; Siemens, 2005; Warger & Dobbin, 2009; Wild, *et al.*, 2009). Research by Brown & Voltz (2005); Khan (2005); Steen (2008) and Warger & Dobbin (2009), base a structured approach on: learning goals, outcomes, objectives, user specifications, strategies, and technology specifications. In taking these six factors into consideration, a further investigation through a needs analysis to map learner requirements is necessary (Grabinger *et al.*,

2007; Merrill, 2002; Naidu, 2006; Siemens, 2005). In addition, planning for the availability, adaptability and flexibility according to the nature and purpose of an e-learning system is necessary (Khan, 2005). According to Lam, Csete and Wong (2005), the practitioner's awareness of components and pedagogical objectives to perform detailed and informed planning prior to development and implementation is also a requirement. In view of the discussion above, planning is now as a key element for effective design.

- **Quality assurance:** Researchers believe that a structured framework guides the process of quality assurance in e-learning systems (Ireland, Correia & Griffin, 2009). Research shows that quality frameworks are structures that identify the range of factors that play an important role to ensure a quality product (Inglis, 2008). This includes the quality factors in the overall e-learning framework that enhance and streamline adherence to standards and controls (Ireland *et al.*, 2009; Mason & Rennie, 2006). Quality assurance further dictates the procedures for correct, consistent, authentic content and activities from the start of learning (Mason & Rennie, 2006; Oliver, 2005).

E-learning standards aim to maintain uniformity for data structures and communications practices in e-learning systems (Liu, Saddik & Georganas, 2003). There is a need for National ICT standards to address: (a) the standards for teacher development in line with the National Qualifications Framework (NQF); (b) relevant, accessible and reliable content, connectivity, hardware, software and adequate community engagement (Department of Education SA, White Paper on e-Education, 2004). The objective of developing standards to maintain quality is to develop technology that would benefit society in a uniform approach. The calls for norms and standards help to maintain a fair and equitable implementation process for education in ICT (Warger & Dobbin, 2009). E-learning quality is assessed according to technology, human, e-resources, information quality (Lee, 2006; Stemposz *et al.*, 2009) and course design with active participation from stakeholders (Mason & Rennie, 2006).

- **User satisfaction:** User-satisfaction depends on varying factors such as the diverse personalities, environmental influences, access to e-learning amenities, learners' experience with technology, courseware, and system design (Brown & Voltz,

2005; Mason & Rennie, 2006; Qureshi, *et al.*, 2011). The study by Qureshi *et al.*, (2011) reveals many problems in an e-learning system result from negative user-satisfaction experiences. The positive perception that users have toward a system steers them to continue using the system and increases their intention to re-use it (McGregor & Turner, 2009; Pituch & Lee, 2006; Sun *et al.*, 2009). Furthermore, the experience and value from by a learner's actual use and interaction with a system is a contributing factor that determines if a learner continues to use that system (Sun *et al.*, 2008). However, research by Steen (2008) records that although e-learning systems lack the elements of individual thinking, teaching and interpersonal skills the careful design of e-learning systems has the potential to adequately address learning and training needs and provide a significant improvement in the rating of user satisfaction.

#### **2.5.10 Summary of pedagogic elements for design of e-learning systems**

The basic pedagogic elements for effective e-learning system design discussed above are concluded in Table 2-8 below and factors into the stages in the proposed e-learning framework as considered in Chapter 4.

<b>Table 2-8: Summary of pedagogic elements for e-learning system design (Summarised by the author)</b>	
<b>Pedagogic elements of e-learning and references</b>	<b>Explanation</b>
Assessment and feedback (Brown & Voltz, 2005; Govindasamy, 2002; Grabinger et al., 2007; Haddad, 2003; Herrington & Oliver, 2000; Ireland et al., 2009; Khan, 2005; Kuchi et al., 2003; Mason & Rennie, 2006; Merrill, 2002; Naidu, 2006; Nam & Jackson, 2007; Warger & Dobbin, 2009)	Encourages outcomes and monitoring of learners, learning processes and system performance against predetermined objectives
Content (Alexander, 2001; Boettcher, 2007; Brown & Voltz, 2005; Govindasamy, 2002; Merrill, 2002; Oliver, 2005; Warger & Dobbin, 2009; Wild, Griggs & Downing, 2002)	Identifies the information or learning material to be delivered to meet the required objectives
Contribution by instructors (Boettcher, 2007; Govindasamy, 2002; Grabinger et	Instructors provide a different view for the design of e-learning systems that strengthen

<b>Table 2-8: Summary of pedagogic elements for e-learning system design (Summarised by the author)</b>	
<b>Pedagogic elements of e-learning and references</b>	<b>Explanation</b>
al., 2007; Hui, 2007; Qureshi et al., 2011 Sun et al., 2009; Wild et al., 2009)	the learning process.
Culture (Boettcher, 2007; Grabinger et al., 2007; Khan, 2001; Mason & Rennie, 2006; Reiser & Dempsey, 2002; Warger & Dobbin, 2009)	People's culture and the culture of learning in the current generation changes as new skills, technology and curriculums change.
Interactivity process (Boettcher, 2007; Grabinger et al., 2007; Herrington & Oliver, 2000; Khan, 2005; Lippman, 2010; Mason & Rennie, 2006; Oliver, 2005; Pituch & Lee, 2006; Reiser & Dempsey, 2002; Sun et al., 2009; Warger & Dobbin, 2009; White Paper on e-Education, 2004)	The interaction among systems, peers, teachers, mentors, supervisors, content and skill is critical to a structured learning process
Learning principles (Alessi & Trollip, 2001; Boettcher, 2007; Grabinger et al., 2007; Haddad, 2003; Khan, 2005; Mason & Rennie, 2006; Merrill, 2002; Nam & Jackson, 2007; Siemens, 2005; Steen, 2008; Warger & Dobbin, 2009; Wild et al., 2009)	Learning principles for a learner-centered approach places responsibility on the learner as a core element and are central to design and development of e-learning systems. Constructivist approaches rather than teacher centered methods are critical for learners to acquire and enhance knowledge to solve problems in real life situations.
Learning process (Blumenfeld et al., 1991; Boettcher, 2007; Kuchi et al., 2003; Mason & Rennie, 2006; Merrill, 2002)	Learning is ongoing and e-learning systems require continuous monitoring and management similar to the process of learning.
Learning style (Boettcher, 2007; Brown & Voltz, 2005; Grabinger et al., 2007; Khan, 2005; Kuchi et al., 2003; Little, 2001; Mason & Rennie, 2006, Merrill, 2002; Qureshi et al., 2011; Pituch & Lee, 2006).	Systems need to accommodate and adapt to new generation of learners and teaching methods to meet changing needs
Planning (Boettcher, 2007; Brown & Voltz, 2005; Grabinger et al., 2007; Khan, 2005; Lam, Csete and Wong, 2005; Lippman, 2010; Mason & Rennie, 2006; Merrill, 2002; Naidu, 2006; Siemens, 2005; Steen, 2008; Warger & Dobbin, 2009; Wild, et al., 2009).	Enables a holistic, analytical view of learner and organizational requirements.

<b>Table 2-8: Summary of pedagogic elements for e-learning system design (Summarised by the author)</b>	
<b>Pedagogic elements of e-learning and references</b>	<b>Explanation</b>
Quality assurance (Inglis, 2008; Ireland, Correia & Griffin, 2009; Lee, 2006; Liu, Saddik & Georganas, 2003; Mason & Rennie, 2006; Oliver, 2005; Stemposz et al., 2009; Warger & Dobbin, 2009; White Paper on e-Education, 2004)	An essential element to maintain accountability and uniformity to standards and controls.
User satisfaction (Brown & Voltz, 2005; Mason & Rennie, 2006; McGregor & Turner, 2009; Qureshi, et al., 2011; Pituch & Lee, 2006; Steen, 2008; Sun et al., 2009)	The perception and attitude of learners towards a system will motivate learners to use a system and increase their intention to re-use it.

### **2.5.11 Conclusion to Research Question 3**

In conclusion, the discussion in Section 2.5 addresses the third research question to identify e-learning frameworks that guide the design of e-learning systems. This study further identifies pedagogic elements for effective e-learning design that will be incorporated into the derived framework in Chapter 4. The components are evident in the five extant frameworks and are outlined in the summary presented in Table 2-8. The specific pedagogical elements of an e-learning system are identified and discussed in this section to ensure that effective planning, learning, development and technological factors be carefully structured to ensure that elements of user satisfaction be attained, quality should be regarded and assessments must be active to monitoring learners' and system performance.

## **2.6 CHAPTER CONCLUSION**

This chapter discussed and presented the literature study relevant to Research Questions 1, 2 and 3 as follows:

- The discussion around the first research question details the need for an e-learning definition inclusive of learning, technology and instruction and results in the derivation of a definition for e-learning.
- The discussion of the second research question reflects on the role of technology and on the dependence of learning on technology to communicate learning and synchronise with learning requirements.
- To address the third research question, this study investigates and highlights the essential contributing factors and characteristics in an e-learning framework from research made in five frameworks. The elements for pedagogy requirements that are relevant to e-learning system design are also explored.

To answer the above three research questions, this study concludes from the research that a structured framework relevant to pedagogical and learning requirements is essential. Chapter 3 presents the research design and the proposed framework for e-learning system design is proposed in Chapter 4, to indicate the stages in which the pedagogic elements are incorporated. Chapter 5 reveals the findings of the empirical research essential to this study.

### 3. RESEARCH DESIGN

#### 3.1 INTRODUCTION TO CHAPTER 3

In Chapter 2, the literature study explored the research which leads to the development of the proposed pedagogic e-learning framework (Chapter 4). This chapter describes the design, development and validation of the empirical research to evaluate the framework that is derived in Chapter 4.

An overview of Chapter 3 is indicative of the research design applied to this study as set out in Figure 3.1. The outcome and findings of the study are presented in Section 5.2 to validate the need and the relevance of the stages in an e-learning framework.

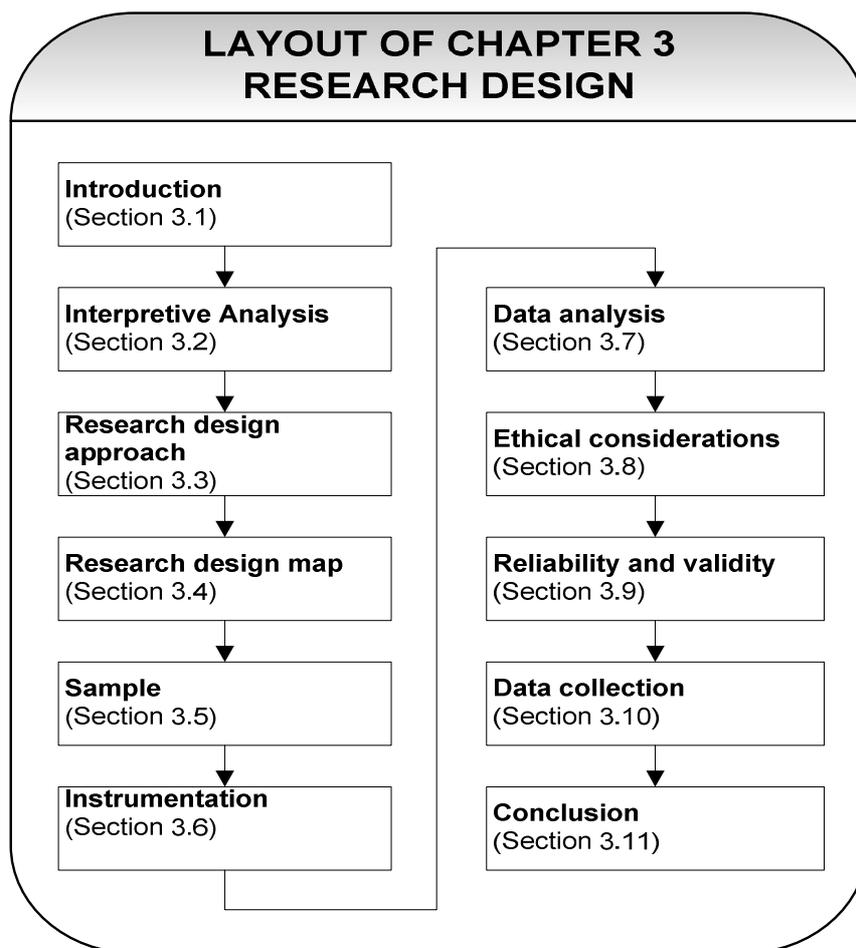


Figure 3-1: Layout of Chapter 3

## **3.2 INTERPRETIVE ANALYSIS**

The author adopted an interpretive analysis approach to understanding the existing literature and the contribution by way of the authors interpretation to the proposed e-learning framework. Included as a precursor to the research design approach taken in this study, the author intended to: present the discussion around the literature study conducted in Chapter 2 relating to the extant e-learning frameworks, models and pedagogic elements that guided e-learning systems design and development; address the components, elements and stages prompting the structure of the proposed e-learning framework; and show the relevance of extant e-learning frameworks, models and pedagogic elements to the formulation of the proposed e-learning framework.

The interpretive analysis method was used to explain and analyse the extant frameworks and pedagogical elements where the author established the dimensions, stages, components and pedagogic elements principles to be applied in the proposed framework. According to Kaplan and Maxwell (1994), interpretative analysis, focused on the complexity of human sense-making as the situation or discussion emerged where there were no dependent or independent variables. The purpose of the interpretive approach was to produce an understanding of the context of information and the process whereby systems influenced and were influenced by the context of the system with the assumption that the access to reality was possible through social constructions such as language and shared meanings (Walsham, 1993). Furthermore, the interpretive approach contained no prescribed theories, instead the theory was based on the author's interpretation and claimed that the information was relevant (Walsham, 1993).

### **3.2.1 Review of literature**

The Research Questions 1, 2 & 3 drew on the literature study in Chapter 2 expressing the derived definition of e-learning where learners, pedagogy and technology were key factors (Section 2.3), the role of technology on e-learning (Section 2.4.2) and explored extant e-learning frameworks, models and pedagogic elements aiding the design and

development of e-learning systems (Section 2.5). The presentation of literature in Chapter 2 suggested the lack of a consolidated pedagogic e-learning framework and relevant pedagogic elements for the design and development of e-learning systems. The literature presented the differing perspectives of e-learning frameworks where the foundation on pedagogy and structure were essential.

The focus was on the extant e-learning frameworks by Clark, 1995; Dick, Carey, L., Carey, J.O., 2005; Huang et al., 2008; Khan, 2001 and Khan, 2004 which provided the study with e-learning frameworks and models where pedagogical elements were partially included, though the lack of a consolidated framework was evident. Khan (2005) believed that in order to develop pedagogic e-learning systems it was necessary to remove elements that served no purpose in a framework and include only useful, essential elements. The need for a consistent approach in the design and development of pedagogical e-learning systems was imperative.

### ***3.2.2 Proposed e-learning framework requirements***

The author's interpretations of the requirements for this study was to derive a framework for the design and development of e-learning systems that aligned with the learning objectives and strategic goals stemming from learning and curriculum requirements with the core focus on pedagogic elements. According to researchers, frameworks were essential in providing guidance and support to any type of learning in e-learning environments (Kuchi et al., 2003) where frameworks and factors prescribed essential elements in achieving positive learning outcomes (Khan, 1997 and Oliver, 2005).

The aim of the framework was to guide the design and development of e-learning systems through dimensions in the framework with the focus on incorporating pedagogic elements at the onset through the: planning stage in order to establish the needs and objectives for e-learning systems; analysis: to further understand and detail the e-learning system requirements, design and development to incorporate instructional methodologies and technology requirements; testing against system and user requirements; implementation and evaluation of the system.

Management and stakeholder support and quality assurance were essential in ensuring relevance and longevity of the e-learning system where the system provided an authentic and significant learning experience. Continuous efforts to maintain and keep the system up to date and acknowledging user feedback and assessments were necessary. The author identified the need to review and improve upon e-learning systems after implementation due to the possible failure of e-learning systems and the non usage thereof. The review and improve stage was intended to review the e-learning systems, whether it was a planned or unplanned process and facilitate improvements on the system accessible through stages in the framework by keeping the system up to date in line possible curriculum changes, technology enhancements or stakeholder requirements.

The relevance of pedagogic elements incorporated in the design and development of e-learning systems were imperative to ensure that the learning needs, objectives and requirements were consistently applied through all the stage in the proposed e-learning system.

### ***3.2.3 Relevance of literature to the proposed e-learning framework***

Based on the approach and the required dimensions and elements to designing and developing e-learning systems, the author accepted and identified the following dimensions, stages, components and elements from each of the following e-learning frameworks, models and pedagogic elements as discussed in Chapter 2 to be incorporated in the framework.

A further detailed account of the motivation for incorporating the components from the frameworks and models below are discussed in Section 4.5:

- In the Technology Enhanced (TEL) Authoring model (Huang et al., 2008) in Section 2.5.3, the author found that the model presented a learner-centered approach in meeting learning needs and objectives focusing on planning, learner styles, needs analysis and course generation. The model explained the pedagogical elements; needs analysis; learning objectives; learning styles;

learning segments; standards and accessibility to the user (Huang et al., 2008). The model presented important factors in the planning stage (identified learning objectives and requirements); analysis (training needs analysis); design (incorporate learning styles in design); development (development of courseware) and quality assurance stages (maintaining standards in line with recognised frameworks).

- The Dick & Carey Instructional Design model (Dick et al., 2005) in Section 2.5.4 focused on presenting the identification of outcomes, objectives, goals, needs; conducting an instructional analysis based on instruction, learning context, identifying prior knowledge, significant testing and development and flow of learning material. Formative and summative evaluations and a revision of instruction were conducted (Dick et al., 2005). The model provided significant input to the planning stage (instructional goals were determined); analysis (identified detailed needs analysis, instructional analysis and performance objectives); detailed design stage (objectives, goals, outcomes aligned to the relevant instruction and activities); the development stage (facilitated development of learning material in line with technology selection); and a comprehensive evaluation stage.
- The e-learning P3 model (Khan, 2004) in Section 2.5.5 detailed stages in the e-learning process, namely: planning; design; production; evaluation; delivery and maintenance; instruction; and marketing and refers to the pedagogy elements and learning needs. From the P3 model, the author found the following stages relevant: concise planning (including pedagogy elements, specific outputs, timeframes, roles and responsibilities; design (presentation of learning content and delivery based on pedagogy and learning needs); development (created learning content and piloted the learning material); testing (diverse learners tested the pilot system); implementation (updated course content and the final system, system and technical support).
- Khan's eight dimensional e-learning framework (Khan, 2001) in Section 2.5.6 identified random steps, through a flexible approach, namely: institutional;

pedagogical; technological interface design; design interface; evaluation; management; resource support; and ethical considerations in conjunction with instruction methodologies. The contribution of this framework involved the: detailed planning stage, highlighting the requirements, goals, outcomes and pedagogic elements; analysis, focusing on technology, infrastructure, learning content and media analysis; the design stage (focused on the user interface, site, usability, content design and navigation).

- The Analysis, Design, Development, Implementation and Evaluation (ADDIE) model (Clark, 1995) in Section 2.5.7 identified the main processes of analysis, design, development, implementation, and evaluation, generated from instructional design models and an iterative model allowed for the assessment and revision of the design when needed. The ADDIE model presented the following stages for inclusion in the proposed e-learning framework: concise planning stage (focus on learning goals, objectives, targets, delivery, limitations and constraints); design (based on a plan guiding the achievement of learning objectives and outcomes, organisation of learning content, instructional methodologies and activities); development (production of learning content, activities, blueprints, selection of media and tools and prepared the system for testing); testing (content and material was tested for functionality and purpose); implementation (smooth delivery of the system to stakeholders).
- In section 2.5.9, the author discussed the pedagogy elements which were important in maintaining learner requirements through the stages in the framework. Researchers identified the pedagogic elements essential in learning context in e-learning systems, where pedagogy guided the effectiveness of the learning process, content, learning activities, assessments, evaluation, instruction and places the learner at the core of all learning processes (Anderson & McCormick, 2005; Beetham & Sharpe, 2013 and Govindasamy, 2002). The pedagogic elements (summarised in Table 2-8) included: assessment and feedback; content; contribution by instructors; culture; influence of technology; interactivity; learning principles; learning process; learning styles; planning;

quality assurance; and user satisfaction. The author found that all these pedagogic elements were essential in stages in the framework. The pedagogic elements in the planning stage (summarised in Table 4-1) included: the focus on the learner in terms of learning principles; learning style; culture; content and curriculum requirements; technology in terms of instruction in line with goals and objectives; contribution by instructors; interactivity of learners, instructors and stakeholders, process of learning and ensuring that learning elements and pedagogical principles were amalgamated. Assessment and feedback formed part of the support dimension (Section 4.2.10) and included the elements of user satisfaction and quality assurance (Section 4.2.11).

In view of the stages, dimensions and components identified above, the author's interpretation of the proposed e-learning framework essentially comprised of 3 dimensions. The foundation dimension (planning, analysis, design, development, testing, implementation and evaluation), support dimension (management support, maintenance, assessment and feedback and quality assurance) and a cyclic dimension for review and improve inclusive of the pedagogic elements that are filtrated through the proposed framework. In order to develop the proposed e-learning framework, the author extracted relevant components, dimensions and stages drawn through the author's interpretation, review and study of the extant e-learning frameworks, models and pedagogic elements. The next chapter, Chapter 4 details the foundation, support and cyclic and review stages and respective pedagogic elements by understanding the context of each stage to guide the development and design of e-learning systems.

### **3.3 RESEARCH DESIGN APPROACH**

The research design described by Leedy & Ormrod (2013) and Babbie & Mouton (2011) was a strategy to planning the research process. Babbie & Mouton (2011) addressed the classification of research design types in which the empirical studies was most relevant to this study. This study adopted a survey as an appropriate form of research from the mapping of the empirical research designs in Babbie & Mouton (2011). The survey was identified as an appropriate means of soliciting evidence in addressing the

research problem and was discussed in detail in Section 3.3.1. The quantitative approach to this study was presented by Babbie & Mouton (2011) as a suitable methodology that measured the participant's attitudes towards the e-learning framework. The quantitative approach is further discussed in Section 3.3.2. The overview and applicability of the form of research used in this study is demonstrated in Section 3.4.

### **3.3.1 Surveys**

The empirical research conducted in this study was based on a survey research design which was quantitative in nature. Surveys involved collecting information about a particular population by carrying out a sample of the group of a population (Leedy & Ormrod, 2013). Surveys were administered to a sample of participants that were selected from a population of convenience.

The purpose of the survey was to evaluate the potential suitability of the proposed e-learning framework using data collected over a short period through self-administered electronic questionnaires.

In this study, the survey was chosen as the preferred research method for its relatively quick response time in data collection and the ability to be able to reach the identified sample group over various geographical locations within a specified duration (Section 3.3.1). The survey research was explained by Babbie & Mouton (2011) as: the selection of a sample (Section 3.5); the construction of the questionnaire (Section 3.6); and the collection of data (Section 3.10). The survey was administered to a chosen sample group through a formal electronic questionnaire that was emailed to participants. The analysis of the data is presented in Chapter 5.

### **3.3.2 Quantitative paradigm**

The quantitative methodology was adopted in this study. The suitability of the proposed framework was evaluated by participants knowledgeable in the field of designing and developing e-learning systems.

The quantitative method was selected to determine the evaluation of the proposed pedagogic e-learning framework.

The following characteristics employed in this study exemplified components of the quantitative methodology according to Leedy & Ormrod (2013):

- Confirmed and validated the responses toward the proposed framework from the survey.
- Utilised a standardised measuring instrument such as the questionnaire.
- Statistically analysed the numerical data using the Likert scale.
- Communicated the research findings through statistical analysis.

In this study, the survey method was chosen utilising questionnaires for evaluation of the proposed pedagogic e-learning framework.

### **3.4 RESEARCH DESIGN MAP**

The essential components validated the research in this study were presented through various stages which guided the empirical research. The structure of this chapter followed the approach of the research design map (Mouton, 2001) and discussed the theoretical approach (Leedy & Ormrod, 2013) for evaluating the framework. The research design map in Table 3-1 presented the foundation and structure that guided the empirical research using the survey method.

The participant's responses were a key concern in evaluating the proposed e-learning framework. A survey was used to solicit participants' responses for the evaluation of the framework where evidence was collected and the data was further analysed.

<b>Category</b>	<b>Mouton's theory of design for surveys (Mouton, 2001)</b>	<b>Application of theory to current study</b>	<b>Reference to current study</b>
<b>Description / Definition</b>	Survey was described as a quantitative approach that strived to provide an overview of the perspectives of a sample group within a population	The survey method was most suited to solicit responses from the sample group in the design and development of e-learning systems.	Section 3.2.2
<b>Design classification</b>	Empirical; numerical; primary data and medium control	Empirical studies collected primary, numerical data by administering questionnaires to a single-group study	Section 3.4 and Appendix C
<b>Key research questions</b>	Surveys described as exploratory, though largely descriptive and causal	This research used the survey validated the stages in the e-learning framework	As per data Analysis in Chapter 5
<b>Typical applications</b>	Organisational surveys; opinion polls; attitudinal surveys; community based surveys; needs assessment surveys	Survey method using a questionnaire completed by role players as identified through their involvement in the development of e-learning systems.	Section 3.4
<b>Conceptualisation / Mode of reasoning</b>	Surveys could be theory-driven aimed at testing hypothesis or alternatively, inductive and a-theoretical (exploratory studies; pilot studies)	Adopted an exploratory study and pilot survey of the questionnaire. Based on the assertion that a unifying framework for e-learning design was needed and could be developed from existing frameworks.	Section 3.5
<b>Selection of cases / sampling</b>	Probabilistic or non-probabilistic sampling (convenience or quota sampling)	Non-probabilistic sampling applied using local and international role players that formed a sample group of convenience	Section 3.4
<b>Mode of observation/ sources of data</b>	Structured questionnaires included mail and electronic; structured telephone interviews	Structured questionnaire communicated through an electronic medium	Appendix C
<b>Analysis</b>	Descriptive and inferential statistics, used analysis techniques and statistical	Descriptive statistics used the Likert scale and graphical representation in the form of tables and graphs.	Section 3.5 and data analysis as

**Table 3-1 Research design map for Surveys adapted from Mouton (2001: 152-153)**

<b>Category</b>	<b>Mouton's theory of design for surveys (Mouton, 2001)</b>	<b>Application of theory to current study</b>	<b>Reference to current study</b>
	graphical representation	Analysis of data was limited due to the poor response and small sample size.	per Chapter 5
<b>Strengths</b>	Potentially generalised to a larger population with a proper sampling design. High reliability based on a well structured questionnaire and high construct validity with proper controls	The findings of the survey could not be generalized due to the small population of role players. However for future research the sample is estimated to be grater, hence generalization would be possible. to enforce the effectiveness of the elements in the e-learning framework	As per data analysis in Chapter 5
<b>Limitations</b>	Survey data could be sample and context specific and criticism of analysis may have occurred due to lack of depth and perspective	Survey was relatively small scale and limitation was not applicable	Section 3.2.2
<b>Main sources of error</b>	Sampling errors; questionnaire errors; high refusal rates; high non response rate; data capturing error; inappropriate selection of statistical techniques	Survey was small scale, minimum scale of errors	Section 3.2.2

### 3.5 SAMPLE

The study was conducted on a non-probability, purposive sampling technique. The method was appropriate and solicited responses in terms of exposure and involvement of the sample group in the design of e-learning systems. The objectivity of participant responses was essential in the design and development of e-learning systems. The role players were selected through an on-line search of service providers from both local and international organisations involved in the delivery of e-learning systems and included: analysts; designers; developers; project managers and executive managers. The e-learning framework under study distinguished between different stages at which pedagogy factors were required to be incorporated. Therefore, targeting the various roles was appropriate to understand participants views in their particular area of

expertise relating to their role in e-learning systems design and development. The rationale behind targeting role players was in order to obtain a fair representation and understanding from participants who were involved at various levels in e-learning system development that understood the variable interpretations of the e-learning framework. The study established the participants suitability of participating in the research and the author initially identified 30 potential participants. Hence the author assumed a response from 30 participants, however only a minimum of 20 participants responded to the initial request to participate and thus formed the sample group. The sample group was relatively small in nature yet it was significant in achieving the objectives of the research. Furthermore, of the 20 questionnaires that were distributed, a low 7 participants returned responses to the questionnaire. Due to the low response rate, the participants that did not respond received another 2 reminders to submit the questionnaire, but no further response was received. The aim of targeting the role players at various levels in the organisation was to establish the varying interpretations of the requirements in the framework. However the analysis was not effective to this degree of comparison as the response from required role players were very limited. The relatively low group for this study was as a result of the low response to the initial request to participants to conduct this study. Due to time constraints, there was not enough time to interview all the participants.

The survey method facilitated through the electronic distribution of questionnaires was apt in this regard for reaching the specified target group over the geographical spread within the stipulated duration. Information detailing the background and purpose of the research was forwarded to participants to obtain participants permission prior to conducting the research.

### **3.6 INSTRUMENTATION**

The research instrument selected in this study was a structured self-administered electronic questionnaire. The questionnaire was designed to solicit biographical information, investigated the understanding of e-learning, the role of technology and further conducted an analysis on the stance of the proposed framework. The purpose

of data collection and analysis in Chapter 5, further established the suitability of the framework for the design of e-learning systems. The questionnaire was inclusive of questions where the participants were given the flexibility to provide their views on a standard platform and their responses recorded and coded according to the Likert scale for further analysis.

The participants were required to familiarize themselves with a covering letter (Appendix A) and a consent form (Appendix B) which provided important information to enable satisfactory completion of the questionnaire (Appendix C) and sought permission for the results to be used during research. A cover letter (Appendix A) explained in detail, the purpose and requirements of the survey.

- **Structure of the questionnaire**

The validity and reliability of the questionnaire depended largely on the measuring instrument applied and was enhanced through the design and structure of the questionnaire.

The aim of the questionnaire evaluated the proposed pedagogic e-learning framework and ascertained the effectiveness of each dimension and corresponding stage in the framework. The structure, order and relevance of questions played an important role in the perception and willingness of participants in completing the questionnaire and achieving high response rate. The participants were presented with 26 questions (Appendix 2), and were required to mark their responses by placing a cross in the corresponding box that depicted their most favorable response. Provision was made for participants to provide comments and suggestions on the questionnaire or on the e-learning framework specifically.

The survey was measured according to the Likert response scale. Leedy & Ormrod (2013) favored the Likert scale when participants' attitudes were evaluated and measured by ascertaining the levels at which the participants agreed or disagreed with the statements. The responses were coded and rated on a scale of 1 to 5 where the values of '1' denoted 'strongly disagree' and '5' denoted 'strongly agree'.

The Table 3-2 presents the layout of the questionnaire in terms of the questions and a short explanation on the responses received. For the purpose of this discussion, the statistics consolidated the ratings for 'strongly agree' (5) and 'agree' (4) as one total and 'disagree' (2) and 'strongly disagree' (1) as a combined total. Section A extracted the biographical data and required specific responses. Section B and Section C required participants to rate the statements on the scale from 'strongly disagree' to 'strongly agree' and made provision for additional comments.

A pilot study of the questionnaire was conducted in order to determine the validity of the content, questions and to ensure an improvement in the structure, formatting, time to complete the questionnaire and logic of the proposed questions.

- **Pilot study of the questionnaire**

The pilot study tested and assessed the validity of the measuring instrument and ascertained any elements of error before the questionnaire was administered to the sample group. A pilot test of assessing the questionnaire was conducted among randomly selected sample of 6 convenience participants that were not part of the survey process. The requirement was to check for inconsistencies, including: structure; content; formatting; logic and adequate time frames in completing the questionnaire. The suggested changes to the questionnaire as a result of the pilot study included: removing the selection scale for the age in years in question 2 and the years of employment in question 4 respectively; making provision for comments from question 5 to question 9 in section B as opposed to allowing for comments after each question and allowing for further comments on the framework itself which generated much debate in question 26. The suggestions, advice and comments from the pilot testing stage were incorporated into the questionnaire and ensured improvement, validity of the research instrument, structure of the questionnaire and logical flow of statements. The final questionnaire was then re-checked before being finally administered to participants having incorporated suggestions from the pilot study. Data from the pilot study was not statistically analysed.

<b>Table 3-2 Motivating factors behind rationale for questions in the questionnaire</b>		
<b>Questions extracted from the questionnaire</b>		<b>Motivation for type of questions asked</b>
<b>Section A: Biographical information</b>		
1	Indicate your gender	<p>The purpose of Section C extracted the participant's biographical information in terms of: gender; age; job title and the number of years in their place of employment.</p> <p>The motivation to use the biographical information identified the demographics for achieving fair representation among participants.</p> <p>The position and duration of employment determined the years and experience in the e-learning environment and contributed to the effectiveness of participants understanding of the context of the questionnaire.</p>
2	Indicate your age in years	
3	The position you are employed in your organization	
4	How long have you been employed at your organization?	
<b>Section B – the purpose of this section is to establish: the level of understanding of e-learning; the role of technology and the usage of an e-learning framework</b>		
5	An e-learning system communicates learning through instruction to promote the transfer of skills	Learning and technology were identified as key points in the planning and analysis stages. It was important to gauge the participants understanding of the importance of learning through e-learning systems as this followed through further questioning in Section C.
6	A structured framework for the design of e-learning systems can significantly reduce the failure of e-learning systems	Question 6 and Question 7 assessed the participants understanding of the proposed framework to understand the impact of learning through e-learning systems.
7	A framework guides the design and development of e-learning systems	
8	Technology that incorporates learning requirements can enhance learning	Question 8 and Question 9 addressed the role of technology as understood by participants, solicited the understanding and assessed the suitability of the design, development, testing, implementation, evaluation and feedback and support stages in Section C of the proposed e-learning framework.
9	Technology advancements influence the learning methods and techniques in e-learning systems	
<b>Section C – the purpose is to assess the stages of the proposed e-learning framework</b>		
10	The planning stage is crucial in determining the goals and objectives of an e-learning system	The motivation behind assessing the suitability of the proposed framework was to address the fourth research question in this study. Section C presented Questions 11 to 26, explored each stage of the proposed e-learning framework, as
11	Specific learner needs and principles are established in the planning stage	

<b>Questions extracted from the questionnaire</b>		<b>Motivation for type of questions asked</b>
12	The analysis stage following planning specifies all requirements for an e-learning system	<p>separate entities as depicted in Table 1-1 in Annexure C. This section in the questionnaire ensured that the pedagogy elements and learning principles were incorporated in each stage and provided structure and guidance to role players in the development of e-learning systems.</p> <p>The reason behind detailing and assessing each step in the proposed framework was to solidify the equal importance of each stage in the proposed framework. Although the core of the proposed framework was central to e-learning system design, the support stages were compulsory stages ensuring relevance, structure and continuity of e-learning systems thus supporting pedagogy requirements. Therefore addressing each stage in Section C of the proposed e-learning framework was necessary in understanding the participants reaction of each stage independently and then assessing the overall proposed e-learning framework to enhance development.</p> <p>In summary, participants stressed for the system to be user friendly and all requirements incorporated in the planning stage. Another comment was that the framework provided further classifications, detail and explanations for each stage.</p>
13	Learning requirements omitted from the planning stage are incorporated in the analysis stage	
14	The design stage is significant to align learning needs with appropriate technology	
15	In the development stage, tutorials and learning material aid learners to improve their understanding of learning content	
16	The testing stage is imperative to test whether the systems design and content is suitable for learning	
17	During the implementation stage, stakeholders are briefed on the complete e-learning system	
18	The evaluation stage improves the overall functionality of the e-learning system	
19	Effective management is needed to monitor the continuity of the e-learning system	
20	A maintenance support function is necessary to minimize system downtime	
21	Learning assessments is essential to monitor learners progress	
22	Feedback provides continuous communication on the effectiveness of the system that may necessitate further system enhancements	
23	Quality assurance is essential to maintain credibility of an e-learning system	
24	The review and improve stage is ongoing to manage changes that need to be made to the e-learning system	
25	The proposed e-learning framework provides a suitable approach to the design of e-learning systems	
26	List any objections or comments you may with the overall framework or any part thereof	

### 3.7 DATA ANALYSIS

Data analysis was conducted to gain understanding of the relationship between the elements in the data and to identify any emerging themes, patterns or trends among the variables. The data analysis in this study was essential and maintained objectivity through statistical procedures by interpreting and drawing logical conclusions from the data that had been collected so the outcomes of the survey instrument could be achieved (Leedy & Ormond, 2013).

The data, for the purpose of this study was analysed using Microsoft Excel where the survey results were measured according to the Likert scale. The statistics presented the data in an organised, logical form using graphical representation of column charts. Participants comments were categorised and presented using frequency counts and column charts. The data collected from the questionnaires were analysed and discussed in further detail in Chapter 5.

### 3.8 ETHICAL CONSIDERATIONS

Ethical considerations were necessary in this study where the participation and feedback involved human elements. Ethical clearance was obtained for this study. A copy of the certificate has been included in Appendix D.

Leedy and Ormrod (2013) identified categories of ethical issues considered during research. The relevance of the ethical categories applicable to this study are presented in Table 3-3.

<b>Table 3-3: Ethical considerations in the study</b> <b>(Adapted from Leedy &amp; Ormrod, 2013)</b>	
<b>Categories</b>	<b>Application of ethical factors to current study</b>
Protection from harm	<ul style="list-style-type: none"><li>• Participants were not exposed to any physical or psychological dangers.</li><li>• Questionnaire was carefully structured and excluded sensitive questions about participants and their employment.</li><li>• Insight provided into the purpose for the research.</li></ul>

<b>Table 3-3: Ethical considerations in the study</b>	
<b>(Adapted from Leedy &amp; Ormrod, 2013)</b>	
<b>Categories</b>	<b>Application of ethical factors to current study</b>
	<ul style="list-style-type: none"> <li>• Participants completed questionnaires in their own environment.</li> </ul>
Voluntary and informed participation	<p>Participants were informed that:</p> <ul style="list-style-type: none"> <li>• The process guaranteed anonymity, permitting voluntary withdrawal at any point with no associated risks or recorded discomfort.</li> <li>• A covering letter and consent form detailed the nature, aim and purpose the role of participants and estimated duration of the study.</li> <li>• Results of the study formed an integral part in the fulfillment of the dissertation for the requirements for a Masters degree.</li> <li>• Researchers and supervisors details provided for communication requirements.</li> <li>• Summary of findings were available upon request on completion of the research.</li> </ul>
Right to privacy	<ul style="list-style-type: none"> <li>• Anonymity and confidentiality maintained.</li> <li>• Only relevant data reflecting the aims of the study were reported on and analysed.</li> </ul>
Honesty with professional colleagues	<ul style="list-style-type: none"> <li>• Research findings reported in a complete and honest manner. Omission of inappropriate language. No bias against persons because of gender, sexual orientation or age.</li> <li>• No misrepresentation or intention to falsify the nature of the findings occurred. Accurate findings presented to evaluate the proposed framework.</li> </ul>
Internal review board	<ul style="list-style-type: none"> <li>• The Ethics Review Committee appointed by the University of South Africa assessed and approved the proposed research methodology (Appendix D).</li> <li>• Prior to any research being conducted, the Ethics Committee approved the legitimacy of the questionnaire from a research perspective.</li> <li>• The responsibility of the board ensured that participants were not harmed through the research and anonymity and privacy was guaranteed following the correct procedures during the research proceedings.</li> </ul>

### **3.9 RELIABILITY AND VALIDITY**

- **Reliability**

A measuring instrument was reliable if it achieved the same results every time a specific technique was applied repeatedly to the same object, provided that the object being measured has not changed (Leedy & Ormrod, 2013). The reliability in this study was

achieved through presenting all participants with a standardised measuring instrument in the form of a questionnaire (Babbie & Mouton, 2011).

- **Validity**

The measuring instrument was is valid if it measured what it was intended to measure in accordance for the purpose for which it was intended (Leedy & Ormrod, 2013). The principles for improved validity included: a broad sample was used, not a narrow one, emphasized the important material, such as the framework related to questions 10-26; wrote statements and questions measuring the appropriate responses. These principles were addressed when the questionnaire was written. The validity of the survey instrument was further improved by a pilot group formed to test and assess the questionnaire before responses were solicited from the sample group.

### **3.10 DATA COLLECTION**

A pilot study was conducted by a small group to receive feedback on the effectiveness of the questionnaire as a survey instrument and to eliminate researcher bias. The feedback eliminated researcher bias and incorporated suggestions and comments used to streamline the structure of the questionnaire to a more manageable approach. The data was collected through a self- administered questionnaire that was forwarded through electronic mail to the participants.

The responses to the survey were recorded, captured and analysed on a spreadsheet using Microsoft Excel. Leedy & Ormrod (2013) recommended Microsoft Excel as a quick method for organizing and evaluating the data collected. Descriptive statistics were calculated and the statistical analysis conducted. The data analysis of the information collected is presented and discussed in further detail in Chapter 5.

### **3.11 CONCLUSION TO CHAPTER 3**

This chapter presented the essential components of the research design and in line with the research objectives explained the relevance of the survey method to the context of

this study. The rationale behind the selection of the sample group was discussed and provided clarity on the importance of the specific need to collect data from knowledgeable participants. To facilitate the effective collection of data the questionnaire was pre-tested amongst a chosen pilot group.

The study detailed the attainment of ethical considerations, reliability and validity and briefly discussed the process of data collection and data analysis.

The following Chapter 5, will present the findings and detailed statistical analysis of the data extracted from the questionnaire, leading to the final Chapter 6 in which the findings, recommendations and conclusion to this study will be presented.

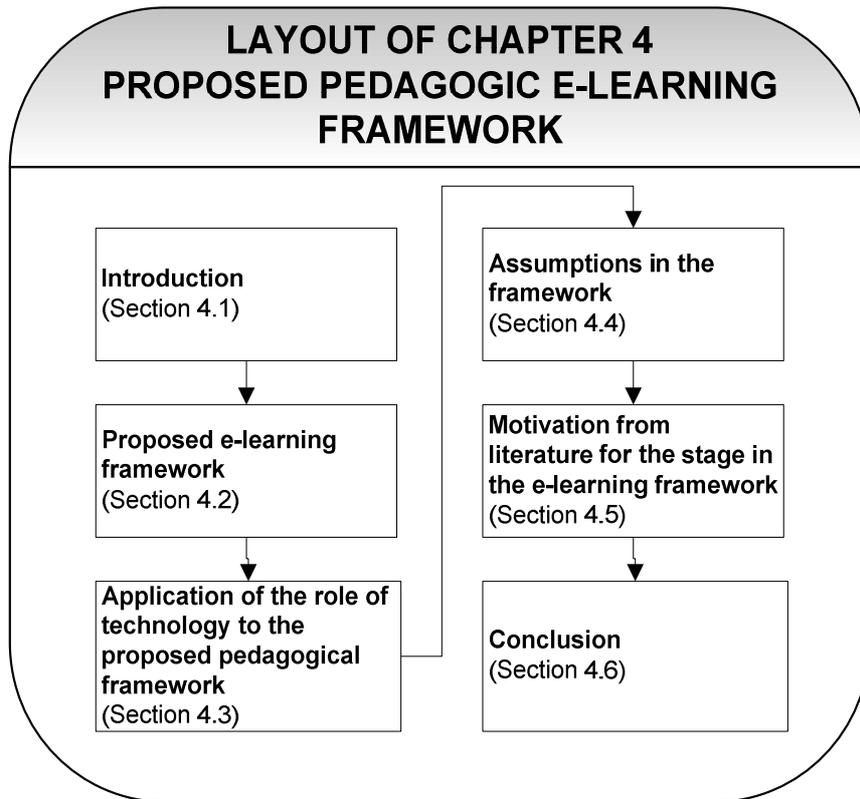
## 4. PROPOSED PEDAGOGIC E-LEARNING FRAMEWORK

### 4.1 INTRODUCTION

Research explored through the literature study in Chapter 2 addressed the first three research questions. This chapter addresses the fourth research question, namely:

**Research Question 4: What is an appropriate framework and its contributing elements to develop and enhance the design of e-learning systems for learning and technology?**

This chapter presents the proposed pedagogical e-learning framework for the design and development of e-learning systems according to the structure outlined in Figure 4-1. The proposed framework comprised of three dimensions, namely: the foundation dimension, the support dimension and the cyclic dimension and included twelve detailed stages as discussed in Section 4.2 and supporting elements as summarised through the literature study (Section 2.5.10). The research through the first research question in Section 2.3 identified the need to consider learning and technology as a focal point and as an essential part of the planning and analysis stages in the foundation dimension. The second research question in Section 2.4 presented the role of technology in learning which was addressed in the design, development, testing, implementation and evaluation stages which were also present in the foundation dimension, and assessment and feedback, management support, quality assurance and maintenance stages which formed the support dimension. The cyclic dimension comprised of the review and improve stage, accessed through any stage in the framework. The third research question, in Section 2.5 of the literature study, presented a consolidated view of the five extant e-learning frameworks summarised in Table 2-7 and the pedagogical elements as summarised in Table 2-8 which was relevant in various stages of the proposed pedagogical framework. This chapter was structured such that the author's proposed pedagogical e-learning framework was presented in Section 4.2, followed by the motivation of the proposed pedagogical e-learning framework.



**Figure 4-1: Layout of Chapter 4**

## **4.2 A PROPOSED PEDAGOGIC E-LEARNING FRAMEWORK**

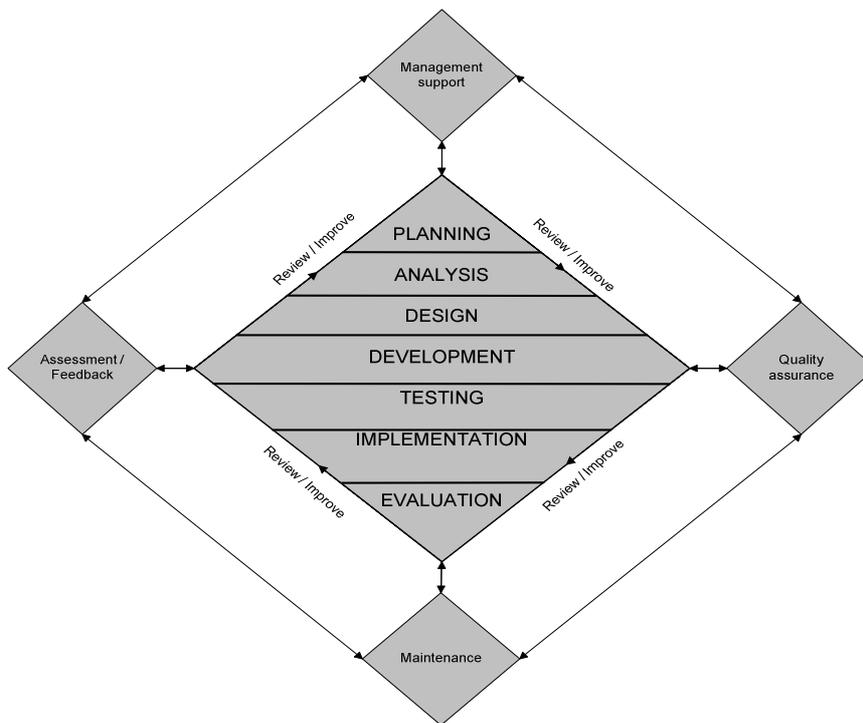
The framework (Figure 4-2) was the author's proposed pedagogical e-learning framework and contribution to this study. The derivation of the pedagogical framework stemmed from research from extant frameworks, models and pedagogic elements. The proposed framework in Figure 4-2 represented a strategic perspective with an overall approach to e-learning systems design and ensured that pedagogy elements were incorporated throughout the framework.

The framework was developed with the agile approach in mind and emphasised continuous development of the e-learning system through an iterative method, instead of a once off approach, specifically taking the review and improve stage into consideration where unplanned changes were initiated. The participation,

communication and involvement of all role players throughout the duration of the system development was imperative to ensure that learning objectives and requirements were accurate and up to date. The agile approach minimised the project risk by considering the stages as a smaller project such that outputs or milestones were achieved quicker and more accurately and at the end of each stage contributed to the relevance of the e-learning system holistically. The agile method was beneficial in this case as project stakeholder's objectives and requirements were met by delivering adaptive systems that allowed for changes and requirements to be reevaluated. Furthermore, the agile approach considered the change in learner needs and requirements and incorporated continuous feedback through the design and development process (Mirnalini & Raya, 2010 and Sedehi & Martano, 2012).

The pedagogical framework was aligned to the achievement of learning objectives and strategic goals ascertained by stakeholders and comprised of three main dimensions, namely: the foundation dimension (planning, analysis, design, testing, evaluation and implementation); support dimension (management, maintenance, assessment and feedback and quality assurance) and the cyclic dimension (review and improve stage). The dimensions in the foundation stage followed an agile cycle approach where design and development followed the steps outlined. Followed by the support dimension, the steps were accessible and conducted through any stage of the framework, allowed for enhancements or updates where necessary. The support dimension also ensured the process of design and development was not conducted in isolation or independent of stakeholder input, quality assurance, support and overall maintenance and could have been initiated prior to the overall completion of the e-learning system. The cyclic dimension ensured that from a pedagogy perspective any changes in learning requirements, curricula and changes in learning due to policies were identified and conducted in a structured manner, and followed the foundation dimension where the outcome and requirements were identified. The support and cyclic stage were performed on an ongoing basis and tapped into the foundation dimension when required. The pedagogy elements maintained a strong learner focus where outputs and details were outlined in each dimension. Stakeholders referred to the learners, instructors, society and government that participated or benefitted from the provision of

education. The aim of the pedagogic framework maintained a structured approach to design and developed an e-learning system from the perspective of ensuring the system remained relevant to all stakeholders and retained the presence of pedagogic principles.



**Figure 4-2: Proposed pedagogic e-learning framework for system design and development**

The core within the Figure 4-2 highlighted the foundation dimension that affected design and development. The foundation dimension included the following stages and relevant sections as discussed in this study:

- Planning (Section 4.2.1)
- Analysis (Section 4.2.2)
- Design (Section 4.2.3)
- Development (Section 4.2.4)
- Testing (Section 4.2.5)

- Implementation (Section 4.2.6)
- Evaluation (Section 4.2.7)

The support dimension detailed the functions necessary to support the proposed pedagogic e-learning framework and was discussed in the study as follows:

- Management support (Section 4.2.8)
- Maintenance (Section 4.2.9)
- Assessment and feedback (Section 4.2.10)
- Quality assurance (Section 4.2.11)

The cyclic stage included:

- Review and improve (Section 4.2.12)

The proposed framework displayed a structured, flexible approach where reviews and amendments made to the project plan could be accommodated for additional requirements and enhancements based on changes encountered during the learning process. Design and development changes required that stakeholders were kept abreast of changes and could plan accordingly. Essentially a planned review of the whole system was conducted to ascertain from stakeholders whether goals and objectives were being met and take into consideration any recommendations or improvements. The aim was to keep stakeholders actively involved in the design, development and maintenance of e-learning systems.

The dimensions of the proposed pedagogic e-learning framework were explained below from Section 4.2.1 to Section 4.2.12.

#### **4.2.1 Planning**

Planning was the first critical stage in the pedagogical framework for the design of e-learning systems. This stage was initiated through an identified need as a means to

satisfy specific learning requirements in a learning environment. The planning stage was the key stage that provided structure to guide all role players involved in the development of the e-learning system and outlined and established learning and technology outcomes, goals and objectives. During this stage the learner's unique abilities and requirements were identified and the outcome of this phase was the project plan. The project plan was a structured reference document for the e-learning system that was applicable to all stages, to review, assess and track achievement of objectives and improvements over a stipulated time frame.

The project plan was detailed and ensured that throughout the proposed framework, the stages were managed and monitored and ensured learning requirements were amalgamated and reviewed. A project team was formed and assigned roles and responsibilities for each stage of the system design process including the overall completion of the system. The planning team further managed the learner's needs and expectations, assessment, feedback, evaluation, implementation requirements, financial feasibility and system expectations from the planning stage. As the term suggested, the planning stage accounted for all eventualities that took place within the entire systematic process. The pedagogic elements prompted investigation in the planning stage included : learners, instructors and stakeholders involved in the process; identifying learning principles; learning style; culture; contribution by instructors; process of learning and content and curriculum requirements. The relevance to pedagogy in this proposed framework ensured that learning elements and pedagogical principles were incorporated at the start of the planning stage. The planning stage was an involved process where the following elements in Table 4.1 were planned for:

<b>Table 4-1 Elements in the planning stage of the proposed framework (Summarised by the author)</b>	
<b>Elements</b>	<b>Description</b>

<b>Table 4-1 Elements in the planning stage of the proposed framework (Summarised by the author)</b>	
Learning	<ul style="list-style-type: none"> <li>• Determined the present status of learning in line with learning principles and levels of learning and defined learner and instructional goals, objectives and outcomes and identified learning types and style of learning</li> <li>• Outlined the learning process and determined level of interactivity. Identified learning conditions, culture, language and mapped a plan to overcome barriers of learning and established motivation factors that enhanced learner satisfaction</li> </ul>
Content/ curriculum planning	<ul style="list-style-type: none"> <li>• Identified learning content transferred during the learning process and determined suitable ways that presented learning material and learning activities,</li> <li>• Defined levels of learning that pitched learning interventions and training and established and planned learning approaches in line with curriculums and policy requirements</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Determined the best suited instruction and methodologies in line with goals, outcomes and objectives and established advantages for selected methodologies that sourced the best option</li> </ul>
Project planning	<ul style="list-style-type: none"> <li>• Established specific roles and responsibilities and contributions expected of the project team and determined the link to existing learning strategies</li> <li>• Solicited contributions from instructors or teachers</li> <li>• Determined delivery dates and timelines for each stage and finalised a project plan</li> <li>• Identified disadvantages and challenges for an e-learning system, planned for drawbacks or eventualities</li> <li>• The design approach and delivery method presented a guide and scope of the entire process from initiation through to completion</li> <li>• Planned maintenance, supported functions and Identified stages for assessments and feedback to learners</li> <li>• Determined the best methods for qualitative control, quality assurance, required standards and established a procedure to review and improve the design of the system</li> <li>• Identified human resources and capacity required. Included dedicated support staff and support structure for e-learning systems</li> <li>• Determined financial resources and budget constraints</li> </ul>

Following from the planning stage, the analysis stage incorporated the outputs from the planning stage.

## **4.2.2 Analysis**

The analysis stage was initiated as the second stage in the proposed pedagogical framework for e-learning system development processes. In the analysis stage, the input of management personnel was essential and required system analysts to play an active role ensuring that effective analysis was conducted and reviewed. The analysis stage was particularly important ensuring all relevant detail forming part of the analysis was included. It was advisable for analysts to check and recheck the requirements specifications for consistency.

The outputs from the planning stage in Section 4.2.1 were analysed against the requirements for e-learning systems. The target audience was established, learning levels, content and resources were determined through a needs analysis. The analysts performed a further review of learners needs and determined the requirements of new or existing technology against required learning content and the motivational state of learners, the durability of content and the need for both management and maintenance support were established. With the inputs considered from the planning stage that feed into the analysis stage, it was imperative that the analyst performed careful analysis against all the inputs provided through the project plan. Together with the investigation of the existing technology infrastructure, the most suitable types of media, learning material and learning activities were analysed. During the analysis, the risks, challenges and constraints associated with stakeholders and the e-learning system were outlined.

The output from this phase was a user requirements specification document that outlined and mapped the entire analysis process based on the planning stage. Based on the projected project plan from the planning stage, the analyst confirmed or provided further inputs according to the analysis performed. The user requirements specification document reflected clear guidelines of the stakeholder's and learning requirements against the project plan.

### **4.2.3 Design**

The design stage of the proposed framework was pursued with an understanding from the user requirements specification from the analysis stage (Section 4.2.2) and from the planning stage (Section 4.2.1) against the project plan. Based on the outlined learning objectives, it was critical to determine the nature of content and planned interaction that established the most suitable method to present learning content. A review of technology was performed and determined whether the existing technology was sufficient and communicated e-learning content or if new technology needed to be sourced. Selection of technology or the review of existing technology was guided by cost-effectiveness, reliability, security, robustness and to a great degree, the applicability of the technology that satisfied the learning requirements. In addition, the technology was required to operate efficiently where the disruption to learning and teaching was minimal.

The output of this phase was storyboards that presented both technical and development related issues in terms of the user interfaces and the systems architecture. The instructional designers utilise strategies and techniques most suited to the learning requirements and develop and present the course content. In this stage the course material are developed based on a curriculum or from an existing source of learning material. The user interface storyboard included: visual, text and audio elements, interactions detailing user interfaces and workflow for each screen including learning objectives. The system architecture storyboard included detail on the system, functionality, controls, business functionality.

Role players were required to maintain consistency throughout design so the learner could become familiar with user interfaces in the learning environment. The designer catered for sufficient contact time in which the learner interacted and engaged with the system. The achievement of learning goals for an e-learning system needed to be enhanced through practice and repetitive actions which were planned against set objectives. The designer needed to acknowledge the type and levels of learning that facilitated the relevant content to be learnt. The interface designers were required to

design the presentation of learning content that promoted user friendly e-learning interfaces. Learning content was also designed with activities that enabled learners to perform assessments and determined their levels of performance that guided future learning requirements. The learner's positive response to a system enhanced learner motivation to use the system and resulted in user satisfaction. Alternatively negative learning experiences resulted in poor performance and poor assessments and were detrimental to learner satisfaction. The designer therefore considered the pedagogy effects as crucial during design to encourage positive, active learning interventions.

**The proposed outputs of the design stage included:**

- Defined instructional objectives.
- The selection of instructional strategies ensured that learner centered tutorials and training material were designed with an easily understandable interface and visuals.
- The organization of learning content was detailed.
- The presentation of content to learners was designed.
- A suitable delivery medium for learning content was selected.
- Activities and exercises were designed to ensure ease of use.
- The assessment and feedback tools are designed to measure the achievement of learning outcomes.
- The design details for development are specified.
- Standards and quality assurance requirements are identified.

The key output is the storyboard reflecting all outputs detailed above.

***4.2.4 Development***

The output from the design stage was in the form of the storyboard (Section 4.2.3) which provided the input for the development stage. In this stage, e-learning system was created. The development stage therefore benefitted from the application of the phases of instruction for effective transfer of knowledge, skill and recognition of prior knowledge. The timelines played an important role in ensuring the design of the

learning system was conducted according to an agreed duration. The schedules required adherence against the project plan. This study identified that the review and improvement stage was important throughout the cycle of the e-learning system where the development of processes required prompt additional changes in the development stage.

**The proposed outputs for this stage included:**

- Developed and produced e-learning system according to specifications as per the storyboard.
- Created learning content and activities relevant to learning objectives.
- Developed or sourced the identified media.
- Used technology and media to present information in required multimedia formats to meet learner requirements.
- Established appropriate, creative, innovative interactions, encouraged learners to navigate further during learning sessions.
- Developed activities and exercises to facilitate a supportive social environment.
- Developed feedback and assessment mechanisms.
- Developed on line e-learning system training manuals to guide the learner through the e-learning process.

The output of this stage was e-learning systems and tutorials to guide learners on how best to use and navigate on the system.

**4.2.5 Testing**

The testing phase of the proposed framework comprised of pilot testing and ensured that the system was developed according to specification and identified shortcomings of the system before the implementation stage. In this stage the learner's expectation and experience with the content, the manner in which it was presented and the interaction and general design of the system were determined. This meant that testing performed on the system necessitated subsequent changes or amendments to the system. The

system was piloted among a selected group of diverse learners within a specified time period, with the intention of making well thought out, necessary changes to the system when required. The testing stage was conducted amongst learners and instructors with the purpose of providing feedback on the system through a structured process. Learners and instructors comments were consolidated and provided to the development team for further investigation and amendments, where necessary. The testing was planned in the design phase to accommodate for possible changes in design. Further testing occurred through learners or designers, internally after changes have been made.

Feedback received during the testing phase was incorporated into the design phase for further development changes. The system and content was also tested for functionality against the technology platform chosen in the design phase.

#### **4.2.6 Implementation**

It was proposed that the completed system be presented in the implementation phase through the most suitable method of instruction. The e-learning system, training material and electronic content formed the output from this phase. Further integration with existing platforms and systems resulted depending on system development requirements.

Routine training was provided in the implementation phase. Stakeholders derived benefit from the tool when made aware of the system operations and were provided with sufficient information to encouraged maximum benefit of e-learning systems.

#### **The proposed key outputs of this stage included:**

- Notification to stakeholders detailing intent of implementing the e-learning system.
- Presentation of a completed e-learning system including course material.
- Monitored implementation of the e-learning system against the time frame allocated to the project.

- Scheduled training interventions and provided training material to stakeholders.
- Ensured the availability of a technical system support team, providing support when necessary.
- Handover of the final e-learning systems to the management team.

#### **4.2.7 Evaluation**

The evaluation stage recorded and improved functionality of the system to all stakeholders. Evaluation of the e-learning system was guided by evaluation plans and evaluation forms that analysed the effectiveness of the learning design process and the e-learning system that supported pedagogy requirements. A further assessment of the learner was carried out to ascertain the relevance of design and development techniques, the quality of the learning provided, method of instruction, layout, design and relevance of content. According to the development process, the learner's feedback was analysed and subsequent changes referred to the development stage. The proposed framework through the review and improve stage recommended that based on the complexity of the change, the request be addressed through the planning stage, maintaining structure in requested changes to the system.

#### **The proposed process of development was evaluated based on factors such as the:**

- Rate of design in line with the estimated timelines on the project plan.
- Nature of design to support learning requirements and meeting goals and objectives.
- Organizational readiness to employ the e-learning system.
- Assessment of learner's satisfaction and ease of use of the system.
- Accessibility and availability of technology.
- Strategic alignment to organizational goals and requirements.
- Senior staff support in the event of system downtime.
- Resource availability in terms of time, cost and expertise.

#### **4.2.8 Management support**

Management support was a critical element as the responsibility of managing e-learning systems tied in with a strong management team that was established at the start of the project. The presence of effective management of e-learning systems in its entirety was controlled from the initiation of the project.

##### **The purpose of management support was to:**

- Manage the e-learning content and maintain the continuity of the e-learning system.
- Ensured that accurate, authentic information was disseminated in line with strategic, organizational goals and objectives.
- Managed the administrative requirements that included learner's academic services and curriculum requirements.
- Maintained and ensured etiquette and ethical concerns.
- Made provision through a strategic plan and effected internal management changes of the system through established roles and responsibilities.

The management support element supported new and existing learners, the learning environment and from a strategic level addressed and aimed to resolve stakeholder's concerns. The level of learners, determined the intensity of learning interventions and training required. The provision for learning support ensured learners were always provided with sufficient help and continued learning minimizing any impeding factors that prevented learning. Support for e-learning was essential and supported learners, maintained user satisfaction and interaction was constantly maintained. Online support, interactive help facilities, and learner prompts were necessary functions that enabled learning. Learners became motivated on receipt of timely support that provided solutions when required. Including support in the management stage ensured from a strategic level, stakeholders continued to share the vision and need for the system and advances and changes in curriculums and technology were managed through a high level process. The support of management aimed for e-learning systems to maintain the goals and learning objectives long after the system was in use.

#### **4.2.9 Maintenance**

Maintenance elements were included in the proposed framework and maintained continuous use of the system with minimum downtime and controlled further infrastructure requirements. Technical support and assistance were provided in this stage. The security measures were instituted and managed. The maintenance stage was responsible for monitoring hardware and software and upgrading and monitoring the e-learning system when required.

The maintenance stage catered for changes to the e-learning system and emanated from changes to learning content, updates on curriculums and further changes to electronic distribution of learning material.

#### **4.2.10 Assessment and feedback**

The assessment and feedback stage identified and monitored the areas in the e-learning system that worked well and the problematic areas that the stakeholders experienced. Through the feedback process, information was received and addressed through a support role that provided assistance and guidance on problems experienced on the e-learning system. Depending on the level of impact and enhancement required to the e-learning system from the feedback received, the assessment of the feedback necessitated further planning. The system required that records of the feedback received are maintained for identification of trends and commonalities among problems that were recorded. The feedback received encouraged stakeholder interaction and enabled reflection on enhancing and updating the system maintaining the relevance of functionality and updated content. Identified as a pedagogic element, assessment and feedback on the proposed e-learning system was a platform for learners and instructors to detail their experiences and assess the levels of user satisfaction.

#### **The proposed feedback stage ensured that the:**

- Stakeholders were provided with accurate information regarding their feedback and responses to the e-learning system.

- Detail responses were provided based on e-learning system objectives and requirements provided at the onset.

Assessments on the e-learning system provided an understanding of the levels of learners that used the system. Teachers were also provided with tools that assessed the effectiveness of the technology used in providing learning. In addition, the instructors view was useful and determined the existing and future instructions needed. Satisfactorily assessing the e-learning system through an automated or online process encouraged stakeholders to become aware and take responsibility for their requirements and objectives to be managed through the e-learning system as per the agile approach.

Feedback and assessment conducted on the e-learning system determined and rectified low performance in the e-learning system as per changing needs at each phase in the framework.

#### ***4.2.11 Quality assurance***

A framework offered significant and realistic direction in the design of quality e-learning systems the meet stakeholder requirements and objectives. Thus, quality assurance ensured that stakeholder satisfaction standards were maintained according to policy, curriculum requirements and strategic objectives of the organisation or institution in line with the agile approach. Establishing a structured and standardised approach in line with recognised qualification frameworks was considered and highlighted in the planning phase. Benchmarking, quality metrics and e-learning quality frameworks were proposed methods of monitoring and maintaining quality assurance according to stakeholders satisfaction.

#### ***4.2.12 Review and improve***

The review and improve stage proved functionally important at every step in the proposed pedagogical framework where systems were to be kept updated with:

- Learning trends, technology updates and research
- Increased e-learning awareness to learners
- Changes and developments in policy and curriculums
- Technology and infrastructure changes
- Suggested improvements or enhancements based on objectives or stakeholder requirements

Reviews of the system and subsequent improvements took place from the foundation dimension through the planning stage in the proposed pedagogical framework. The aim was to manage enhancements through the cyclic dimension in maintaining a structured approach. The role of the cyclic dimension was imperative and considered changes in stakeholder requirements, objectives and included comments and outcomes received through the assessment and feedback stage.

### **4.3 APPLICATION OF THE ROLE OF TECHNOLOGY TO THE PROPOSED PEDAGOGICAL FRAMEWORK**

The role of technology discussed in Section 2.4.2 addressed requirements for specific stages in the e-learning framework as indicated in Chapter 4. The stages of the framework initiated through the planning stage made provision for increased accessibility to information (Section 4.2.1). Further analysis, design and development (Sections 4.2.2, 4.2.3 and 4.2.4) required the inclusion of activities and instructional media to be determined in line with testing (Section 4.2.5). The guidance of management and administrative support through a technology medium was proposed in Section 4.2.8, maintenance was discussed in Section 4.2.9 and feedback and assessment was managed through Section 4.2.10. Quality assurance was presented in Section 4.2.11 and the review and improve stage was discussed in Section 4.2.12. The overall view was that the role of technology was established through the requirements for e-learning systems. Planning for learning and technology requirements in the initial stage created a parallel path for learning and technology that needed to develop simultaneously during conceptualisation of systems. This created a synergy for technology that created a medium for communication of the learning content and

satisfied learning requirements through a structured approach. Further considerations of technology were then carried in a parallel fashion through all the stages in the framework in line with recommendations to incorporate pedagogy factors. In considering the role of technology, the proliferation of learning was therefore in accordance with the most suitable technology fit for the learning purpose.

#### **4.4 ASSUMPTIONS IN THE PROPOSED FRAMEWORK**

The assumptions made in terms of the proposed pedagogic e-learning framework included the following:

- The proposed e-learning framework was dependent on the identified need and objective for e-learning systems.
- The proposed framework provided a holistic view of the system and considered all elements in the framework as essential.
- The proposed framework was aligned to the achievement of learning objectives and strategic goals as ascertained by stakeholders.
- The proposed framework maintained continuity, with the review and improve stage guiding the framework through a structured process where change or improvement was necessary.

#### **4.5 MOTIVATION FROM LITERATURE FOR EACH STAGE IN THE E-LEARNING FRAMEWORK**

The proposed e-learning framework was presented through a strategic perspective with an overall approach to e-learning system design guided by the models and frameworks (Clark, 1995; Dick, et al., 2005; Khan, 2001; Khan, 2004; Huang *et al.*, 2008) selected from the research considered in the literature study.

The literature study highlighted critical concerns and raised relevant factors from frameworks to ensure adequate planning, analysis and determined goals and

objectives. E-learning frameworks and models were identified, analysed and summarised with attention to elements for effective design. Role players in e-learning system design took the learning and technology advancements into consideration for ways to best increase and balance learning. The task of designing an effective learning system and creating an effective environment for continued learning was the responsibility of all role players. The assumptions in Section 4.4 were made in the formulation of the framework that established an understanding of the structure and logic of the framework.

The e-learning definition derived in Section 2.3.2 formed the foundation leading to the derivation of the framework in Figure 4-2 in this section. The reason being that among other elements detailed in the proposed framework above, there was a need to highlight and balance pedagogy and technology, as essential factors for consideration. Pedagogy elements in an e-learning system were considered in this study, with the emphasis on role players becoming aware of what and how learners are required to learn through a pedagogy-technology medium. The motivations below discussed each dimension and corresponding stage of the framework and in some instances the discussion is summarised in the form of a table for ease of reference.

#### **4.5.1 Planning**

The motivating factors on the use of planning as an initial step of the proposed framework, was that the delivery of an e-learning environment had to depend on a planned approach. Literature presented in Section 2.5 on the frameworks and design elements highlighted the requirement for a planning stage and the discussion presented in Section 2.4 explained the need to include the role of technology in this stage. According to researchers (Alessi & Trollip, 2001; Grabinger *et al.*, 2007; Khan, 2000; Khan, 2005; Lippman, 2010; Little, 2001; Merrill, 2002; Naidu, 2006; Siemens, 2005; Sun *et al.*, 2009; Warger & Dobbin, 2009; Wild *et al.*, 2009) there was a critical need to guide the development of an e-learning system. As a result learning outcomes, goals and objectives were required to be outlined and established at the start of the process

(Mager, 1997 and Warger & Dobbin, 2009), identifying unique learner’s abilities and requirements for a learning environment (Steen, 2008).

The discussion in Chapter 2, in Section 2.5 pointed, out the inclusion of elements in an e-learning system. The importance of including the elements stemmed from the overall need of this study to consider the pedagogical factors in e-learning as a key input. Moving toward designing systems that would be fit for e-learning purposes (Gruender, 1996, Kuriloff, 2001 and Oliver, 2005) meant that specific pedagogy requirements were essential to home in on the relevant learning requirements responsible for the purpose of the e-learning system. The need to detail the planning stage into specific elements was also taken as a precautionary measure against the implementation of a technology system before pedagogy requirements were recorded (Khan, 2005).

Learner’s needs, expectations, assessment, feedback, evaluation, implementation requirements, economic feasibility, technology and system expectations were also required to be managed from this stage from a planning perspective (Little, 2001), by a planning team with assigned roles and responsibilities (Khan, 2004). The elements in an e-learning system presented in Section 2.5.9 made reference to several elements for further investigation in the planning stage. Schacter (1999) pointed out that by obeying dimensions of learning; careful consideration of the learning environment; well capacitated human, systems and technological facilities within a professional, responsible environment would be essential to addressing learner needs. A consolidated view of the frameworks in Chapter 2, Section 2.5 and Table 2-8, reflected the relevant areas that should form part of the planning stage in the proposed e-learning framework. The following Table 4-2 presented the research on e-learning frameworks that are relevant and provided input to the planning stage in this section.

<b>Table 4-2: Summary of the planning stage of the proposed framework (summarised by the author)</b>	
<b>Reference</b>	<b>Description</b>
Clark (1995)	<ul style="list-style-type: none"> <li>• Planning for learning used information about the target audience for the entire process, and established: goals; objectives; outcomes; learning requirements, prior knowledge,</li> </ul>

<b>Table 4-2: Summary of the planning stage of the proposed framework (summarised by the author)</b>	
<b>Reference</b>	<b>Description</b>
	current methods of delivery, limitations and constraints.
Khan (2001)	<ul style="list-style-type: none"> <li>• Emphasised planning focusing on audience, goals, plan design approach, strategies and organization and considered social, political influence, cultural diversity, bias, geographical diversity, learner diversity, digital divide, legal issues, information accessibility &amp; etiquette.</li> </ul>
Khan (2004)	<ul style="list-style-type: none"> <li>• Developed a project plan (included pedagogy, time frames and finance) as a key output to outline guidelines for effective e-learning environment.</li> <li>• Stipulated purpose of role players, importance on pedagogy, assigned detailed roles/responsibilities to adhere to the project plan, detail stages of the e-learning process with activities pertaining to project teams.</li> <li>• Guided stages of the entire process through to completion.</li> </ul>
Dick et al., (2005)	<ul style="list-style-type: none"> <li>• Specified instructional goals, to establish desirable outcomes. A distinct difference between instructional goals and needs analysis was established.</li> </ul>
Huang <i>et al.</i> , (2008)	<ul style="list-style-type: none"> <li>• Emphasised formulation of learning objectives, learning needs learner styles and learning segments.</li> </ul>

The planning stage in the proposed framework was guided by the combination of elements for e-learning system design and the factors presented in Table 4-2. The planning stage constituted the amalgamation of inputs, from literature highlighted in Chapter 2 that re-iterated the need to incorporate pedagogy elements from the initial stages of system development. The output of this stage was the project plan which formed the input into the next stage of analysis.

#### **4.5.2 Analysis**

The pedagogic framework detailed the analysis stage, examined the outputs from the planning stage and provided a detailed understanding of pedagogy requirements. Ineffective systems could have resulted from misunderstandings of system requirements or omission of critical factors that ought to have been included in the analysis. The discussion in Section 2.4 analysed the technology role and elements of

e-learning systems relevant to this stage. The following Table 4-3 presents a summary of the frameworks in Section 2.5. that reflected the presence of the analysis phase in the corresponding frameworks. The description details the types of analysis and important steps followed in the analysis stage:

<b>Table 4-3: Summary of the analysis stage of the proposed framework (Summarised by the author)</b>	
<b>Reference</b>	<b>Description</b>
Khan (2001)	<ul style="list-style-type: none"> <li>• Examined technology infrastructure, planning, hardware and software, content, audience, goal, medium and media analysis.</li> </ul>
Clark (1995)	<ul style="list-style-type: none"> <li>• Analysed and initiated development of content and information from the planning stage and guided the design for the entire process.</li> <li>• Instructional designers interpreted information in this phase, and presented the findings, through an accurate analysis.</li> </ul>
Dick et al., (2005)	<ul style="list-style-type: none"> <li>• Instructional analysis identified knowledge and skilled the learner required to reach goals, displaying all steps diagrammatically. Analysis conducted on the target audience and learners. Established their behavior and prior experience, based on tasks; information-processing and learning-task analysis.</li> <li>• Identified entry behaviors and determined learner's needs required to complete the task and established if a learner possessed the requirements to learn new skills.</li> <li>• Criteria for performance objectives determined test items employed in the system where the key was to be specific in establishing if objectives were achieved and tested if the learner acquired the desired skill.</li> <li>• Performance was measured before developing lesson plans and instructional material.</li> </ul>
Huang <i>et al.</i> , (2008)	<ul style="list-style-type: none"> <li>• Performed training needs analysis.</li> </ul>

The output of the analysis phase in the proposed pedagogic e-learning framework was the user requirements specification document that was required as an input to the design phase.

### **4.5.3 Design**

The design stage of the proposed framework was pursued with an understanding from the planning (Section 4.2.1) and analysis stage (Section 4.2.2). The discussion on the

role of technology in Section 2.4 was highlighted in this stage as the most relevant technology needs to be implemented in line with pedagogy elements. Although this phase drew on the outputs of the first two stages of the proposed framework, there was still a review process to ascertain that all elements of pedagogy (summarised in Section 2.5.10) are included (Khan, 2004). Yet the aim was to ensure that objectives and learner needs were addressed through careful design of learning environments and instruction for maintain a learner-centered approach (Reiser & Dempsey, 2002). The motivation behind the design stage was that researchers identified this stage as a means to design a platform on which the learners directly interacted with the system. The direct inclusion of pedagogy was is in this stage of the framework (Khan, 2004). A summary of the factors included in the proposed e-learning framework was motivated by factors in the following Table 4-4.

<b>Table 4-4: Summary of the design stage of the proposed framework (summarised by the author)</b>	
<b>Reference</b>	<b>Description</b>
Clark (1995)	<ul style="list-style-type: none"> <li>• The focus was on design followed from a plan or strategy based on the outcomes.</li> <li>• Guided how the learning was required to satisfy the learning outcomes, objectives; organization of content; instructional strategies; exercises; learning activities; presentation; delivery methods; activities; exercises and measurement of outcomes.</li> </ul>
Khan (2001)	<ul style="list-style-type: none"> <li>• Established the overall look and feel of e-learning systems. Encompassed interface design including page and site design, content design, accessibility, navigation and usability testing.</li> </ul>
Khan (2004)	<ul style="list-style-type: none"> <li>• Instructional designers and interface designers was key to this stage, incorporated learning content, presentation and an appropriate delivery method selected based on learner needs.</li> <li>• Course content and evaluation functionality was designed and reviewed in line with pedagogy and an understanding of learner needs.</li> <li>• In this stage, role players included instructional designers, specialists, researchers and design coordinators reviewed content producing a “storyboard” as an output for this stage.</li> </ul>

<b>Table 4-4: Summary of the design stage of the proposed framework (summarised by the author)</b>	
<b>Reference</b>	<b>Description</b>
Dick et al., (2005)	<ul style="list-style-type: none"> <li>• Performance objectives were identified, detailed needs, goals and specific objectives. The skills in the instructional analysis are translated into complete descriptions of what students will be able to do after completing the instruction.</li> <li>• This step identified if the instruction related to the identified goals and conditions of learning. The instructional strategy included the sequence and method of delivery.</li> <li>• Detailed the steps that implemented the learning plan and concentrated on developing activities; content presentation; developed learner participation; testing and followed through activities.</li> <li>• Outlined the instructional activities aim to achieve the required objectives.</li> </ul>
Huang <i>et al.</i> , (2008)	<ul style="list-style-type: none"> <li>• Learning objectives were presented to the learning as per the learners learning style.</li> </ul>

This stage was responsible for effective use of ICT in the e-learning system. The assumption was that the combination of technology with structured, high quality learning design, significantly encouraged the learner to actively participate in the learning activities and resources as opposed to the interaction based on ICT alone (Mason & Rennie, 2006). The design stage was necessary to design an e-learning system with a greater duration of meaningful contact time within which a learner interacted with the system (Boettcher, 2007), with practice and repetitive actions performed against set objectives or learning goals facilitated the content to be learnt (Merrill, 2002; Merrill, Barclay & van Schaak, 2008). Through the role of technology in Section 2.4, Alessi & Trollip (2001) detailed instructional methodologies that were applicable to providing instruction in required e-learning systems. The relevance of any of the instructional methodologies would be determined by the learning environment in question.

Khan believed that a well designed e-learning system required elements that facilitated learning against the required platform (Khan, 2005) and contributed the need for a storyboard which detailed both technical and development concerns (Khan, 2004). The design of course content was stressed to a large degree in conjunction with the selection of suitable technology for delivery of e-learning content by Naidu (2006).

Instructional designer's utilized instructional strategies and techniques most suited to the learning requirements in order to develop the course content (Alessi & Trollip, 2001). In this stage the course materials were developed based on a curriculum or from an existing source maintaining consistency of learning material. Interface designers designed the presentation for user friendly e-learning content with activities designed to perform assessments and determine performance levels (Khan, 2004).

Knowledgeable, skilled professionals and qualified specialists were needed to map the design process (Little, 2001). Little (2001) drew focus on best practice design principles and highlighted the information education, support and training options made available through e-learning systems. Flexibility was integral in the design process and planning for the availability and adaptability of an e-learning system supported Khan's (2005) view. The factors of improved communication that enhanced a sustainable environment were also identified (Sun *et al.*, 2009). Further input on learners or target groups were required and informed the type of media and instruction utilized (Alessi & Trollip, 2001).

#### **4.5.4 Development**

The storyboard was a suitable tool that provided the basis for development based on a plan or outlined what constituted the development of the e-learning system (Khan, 2004). Researchers recognised the value of the development stage however the input into a system of a learning nature required additional attention from the previous mentioned stages in terms of analysis and planning of relevant pedagogy-technology factors (Clark, 1995). The contribution of the role of technology (Section 2.4), the components within the frameworks from Section 2.5 and the elements in the development stage in the proposed framework is motivated by the research summarised in Table 4-5.

<b>Table 4-5: Summary of the development stage of the proposed framework (Summarised by the author)</b>	
<b>Reference</b>	<b>Description</b>
Clark	• Involved the creation of activities and blueprints, production of learning and content in a

<b>Table 4-5: Summary of the development stage of the proposed framework (Summarised by the author)</b>	
(1995)	<p>system based on the requirements formed in the design phase.</p> <ul style="list-style-type: none"> <li>• Based on the objectives and measurement tools detailed in the design phase, media, tools and processes are selected to create the learning material.</li> <li>• Material pertaining to the learning system was collected and the system was prepared for testing.</li> </ul>
Khan (2004)	<ul style="list-style-type: none"> <li>• Actual content was created and active communication required in the event of change requests.</li> <li>• The system was piloted among a selection of diverse learners irrespective of demographics with provision for their comments and based on feedback, designers worked on amendments where necessary.</li> <li>• The output was course material.</li> </ul>
Dick et al., (2005)	<ul style="list-style-type: none"> <li>• Development of material incorporated the choice of multimedia, learning manuals; instructions; tests and an instructor manual.</li> <li>• This step highlighted the best selected technology or medium that: presented the materials; monitored practice and feedback; evaluated and guided students to the next activity whether it was remediation, enrichment, or the next lesson.</li> </ul>
Huang <i>et al.</i> , (2008)	<ul style="list-style-type: none"> <li>• Courseware was generated and guided from the learning objectives.</li> </ul>

The development stage was presumed to be a time-consuming stage. The importance of the project plan detailed in the planning stage (Section 4.2.1) was again emphasized. The timelines were to be adhered to, considered that checks and tests in the system required additional changes in the development stage and extended the timeline (Khan, 2004). Development was the actual creation of learning with the consideration for interaction and planning for piloting or testing the system (Siemens, 2005). The first principles of instruction detailed by Merrill (2002) and the phases for instruction presented by Alessi & Trollip (2001) identified the need for relevant content, skills and the transfer of skills through a structured approach. The development stage in the proposed framework therefore benefitted from the application of the pedagogy principles and phases of instruction for effective transfer of knowledge and skill and recognition of prior knowledge.

#### 4.5.5 Testing

The testing phase of the proposed framework was motivated by frameworks highlighted in Section 2.5 and the role of technology in Section 2.4. Clark (1995) and Khan's (2004) contributions are summarised in Table 4-6. Testing was essential in systems and there was also, largely a need to conduct a pilot testing exercise on the e-learning system before deployment (Khan, 2004). It was in the interest of the role players in the systems development team that the learner's expectations and learning resources remain managed through a pilot testing stage. During this stage, testing was performed to determine learners experience with the learning content, the presentation of learning material, levels and relevance of instructional methods, learner interaction with the system, overall system design and the effectiveness of technology to communicate learning content (Siemens, 2005).

<b>Reference</b>	<b>Description</b>
Clark (1995)	<ul style="list-style-type: none"><li>• The instructional designer was required to test all content and material for functionality, purpose and appropriateness.</li></ul>
Khan (2004)	<ul style="list-style-type: none"><li>• The system was piloted among a selection of diverse learners with provision for their comments, irrespective of demographics.</li></ul>

According to Khan (2004), the testing stage was conducted with learners and instructors that underwent pilot testing and provided feedback on the system through a structured process. The system and content was tested for functionality against the chosen platforms (Clark, 1995). Learners and instructors comments were consolidated and provided to the development team for further investigation and amendments. The testing was planned in the design phase and accommodated possible changes in design. Further testing was conducted internally through learners or designers after changes were made and favorable response to systems would only be established after systems had been utilized by stakeholders (Govindasamy, 2002).

Siemens (2005) believed that feedback received during the testing phase was incorporated into the design phase for further development (Siemens, 2005). This study recommended that additional changes be investigated further in terms of the impact on the e-learning system and depending on the level and extent of the change requests be reverted back to the planning stage or the design stage. This decision required further analysis depending on the extent of the change.

#### **4.5.6 Implementation**

Researchers highlighted the delivery and integration of e-learning systems and learning material into existing platforms and systems. Therefore the proposed pedagogic framework considered both the integration of new and existing e-learning systems based on an existing platform. The implementation stage highlighted the contribution of Section 2.4 and the frameworks by Clark (1995) and Khan (2004) are summarised in Table 4-7 below.

<b>Table 4-7 Summary of the implementation stage of the proposed framework (Summarised by the author)</b>	
<b>Reference</b>	<b>Description</b>
Clark (1995)	<ul style="list-style-type: none"> <li>• The implementation phase followed from development and presented the system to the stakeholders where a smooth transition of the system is desired.</li> </ul>
Khan (2004)	<ul style="list-style-type: none"> <li>• Course material and updating course content was provided in a secure environment.</li> <li>• System and technical support made available.</li> <li>• Active role players were responsible for maintenance of the system and environment.</li> <li>• The output was updated “learning material” and the instruction team delivered the final learning “product” through the most suitable method of instruction.</li> </ul>

Khan (2004) suggested that the completed system presented at this stage together with the necessary e-learning training and course material be handed over to the stakeholders for delivery (Clark, 1995).

#### 4.5.7 Evaluation

Evaluation recorded and improved the benefit of systems to stakeholders and constituted an ongoing process (Khan, 2010). Other researchers recognised the success of e-learning was measured against the achievement of goals and objectives, target groups, organization structure, culture (Kruse, 2004, Qureshi *et al.*, 2011) and concluded in the planning phase (Clark, 1995). The summary in Table 4-8 presents the discussion to motivate the inclusion of the evaluation stage in the proposed framework.

<b>Table 4-8 Summary of the evaluation stage of the proposed framework (Summarised by the author)</b>	
<b>Reference</b>	<b>Description</b>
Clark (1995)	<ul style="list-style-type: none"> <li>• The ADDIE model contained checkpoints in each phase and evaluated the completed work, ensuring the desired goals were achieved.</li> <li>• Measured course achievements, objectives and progress of achieved outlined goals.</li> <li>• Evaluation included summative and formative assessments.</li> </ul>
Khan (2001)	<ul style="list-style-type: none"> <li>• Includes assessment and evaluation of learners, content, instruction and learning environment.</li> </ul>
Khan (2004)	<ul style="list-style-type: none"> <li>• Comprised of formative, summative and ongoing evaluation.</li> <li>• Formative: evaluated and changed the system during development.</li> <li>• Summative: constituted the final assessment of the product.</li> <li>• Feedback from pilot testing and learners were part of evaluation and possible redesign.</li> <li>• Approved course material distributed to target groups and revised course material was an output for this stage.</li> </ul>
Dick et al., (2005)	<ul style="list-style-type: none"> <li>• Data collected from various established evaluation methods</li> <li>• Revision of instruction conducted after Steps 4, 7 and 8.</li> <li>• Formative evaluation involved collection of data and information during the stage when instruction was developed and used to improve the effectiveness of the instruction</li> <li>• The revision of the instruction attained clarity, tests assumptions, reviews, assesses impact and feasibility.</li> </ul>

This study recognised that evaluation was ongoing, continually analyzed the effectiveness of the learning design process, the e-learning system and organizational assessment of the learner for improved design and development. The quality of the

learning provided, method of instruction, layout, design and relevance content was also evaluated (Siemens, 2005).

#### **4.5.8 Management support**

Based on the discussion in Section 2.5, this study recognised the need for effective management support components for maintained control over e-learning systems before, during and after implementation. The structure of the proposed pedagogic framework through the cyclic review and improve stage enabled the identification of inadequacies or threats to e-learning systems which can be prevented when signs of system inefficiencies are detected and managed in time.

It was necessary for a management team to manage e-learning content, development and the e-learning environment from a systematical perspective (Khan, 2004 and Naidu, 2006). Management support effected maintenance of learning environments, dissemination of information, managed administrative, academic affairs, student services, legal, policy implications, etiquette, ethical concerns, support for technology and infrastructure (Khan, 2001 and Naidu, 2006). Leadership decisions related to implementation, staff development and evaluation plans were detailed. Management responsibility spread over adherence to security issues, gender, discipline, culture, government policies and agenda and support was provided by addressing and resolving learner queries and considered the factors of people, processes and products (Khan, 2004).

#### **4.5.9 Maintenance**

The frameworks in Section 2.5 recognised that the support for e-learning was essential to learners to maintain user satisfaction and interaction (Khan, 2004). Online support and resources were necessary for meaningful learning environments (Khan, 2001). The support component also provided training to learners to enable them to become better acquainted with the system (Khan, 2004).

Khan suggested the establishment of a team of dedicated support staff and planned support structures be instituted for e-learning systems. In order to maintain an effective e-learning experience, the e-learning systems provided an uninterrupted service and maintained continuous learning. Technical support and assistance, security measures, maintaining and distributing learning material, monitoring hardware and upgrading and monitoring the e-learning system was required in this stage (Khan, 2004).

#### **4.5.10 Feedback and assessment**

Feedback identified problematic areas through peer comments and provided assistance and solutions on problems experienced (Jochems *et al.*, 2004 and Merrill, 2002). Feedback and assessment was identified in Section 2.5 and conducted on e-learning systems (Khan, 2010), aimed at rectifying and determining low performance in e-learning systems (Dick *et al.*, 2005 and Naidu, 2006). Feedback via online or offline mediums encouraged communication and suggestions (Siemens, 2005).

Assessment provided evidence, of an understanding of levels of users of the e-learning systems and determined existing and future learner's instruction needs through assessment tools (Alessi & Trollip, 2001 and Merrill *et al.*, 2008). Satisfactorily assessing the process by completing tasks encouraged stakeholder awareness and responsibility (Alessi & Trollip, 2001 and Reiser & Dempsey, 2002). Effectively, provisions for evaluation and assessment considered in the planning stage enforced monitoring of learning environments for improvements in areas where it was recognised that a downfall was likely to occur (Warger & Dobbin, 2009; Wild *et al.*, 2009).

#### **4.5.11 Quality assurance**

Quality assurance was identified in Section 2.5.9 and required to be managed in a fair process. The motivation according to (Ireland *et al.*, 2009 and Mason & Rennie, 2006) was that quality assurance ensured the adherence to standards and controls for authentic, accurate learning content in e-learning systems. Quality assurance offered significant, hypothetical and realistic direction in the design of quality e-learning

environments (Ireland *et al.*, 2009). Standards were maintained and ensured quality assurance (Huang *et al.*, 2008) based on an established structure and standardised approach in line with recognised qualification frameworks as considered in the planning phase. Benchmarked quality metrics and e-learning quality frameworks were proposed methods that monitored and maintained quality assurance (Ireland *et al.*, 2009; Oliver, 2005; Stemposz *et al.*, 2009).

#### **4.5.12 Review and improve**

The review and improve process was proposed from the discussion in Section 2.5. The process was ongoing, where the system was required to be updated with current learning trends, research and increased e-learning awareness to learners. On the other hand, review and improvements on the system itself was managed, with revision proposed in all stages (Khan, 2004). The proposed framework aimed to contain some flexibility so far as proposed changes and enhancements were reviewed. Any proposed changes reverted back to the planning stage and maintained a structured approach for standardised amendments. The learning processes, curriculums and policy developments necessitated changes and required further planning to adapt the e-learning system accordingly (Khan, 2004).

## **4.6 CONCLUSION TO CHAPTER 4**

This chapter proposed a pedagogical e-learning framework as a coherent structured, systematic approach detailing the dimensions and stages that were relevant in developing and designing e-learning systems. The proposed framework took into consideration the pedagogical elements relevant in establishing learning-technology requirements based on identified learning needs and learning outcomes.

The significance of pedagogy, the learning process and the role of technology were recognised as key factors in the design and development of e-learning systems following an agile approach. Hence, the dimensions in the proposed pedagogic framework acknowledged relevant learning goals, objectives and outcomes and the

possibility of change enabling the e-learning system to accommodate the amendments or enhancements through an adaptive approach. The stages in the proposed pedagogic framework included: planning, analysis, design, development, testing, implementation; evaluation, management support; quality assurance; maintenance support; assessment and feedback and review and improve.

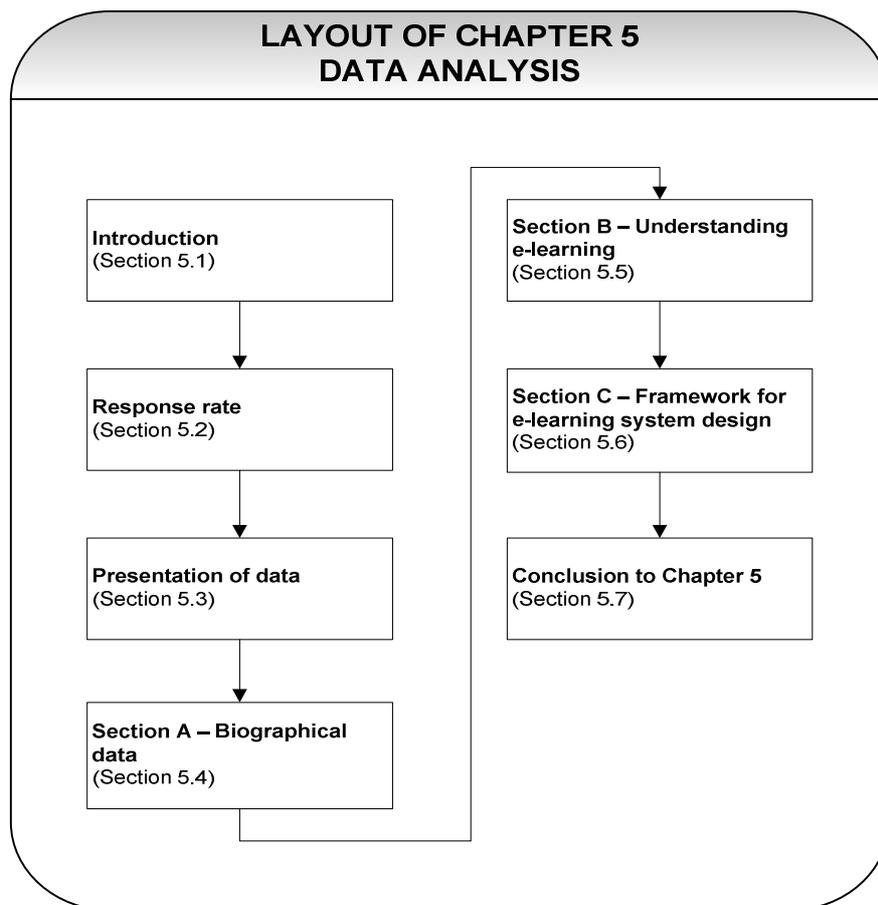
The previous chapter, Chapter 3, detailed the research design and the empirical research carried out by this study, with Chapter 5 presenting the data collection and analysis. The concluding chapter, Chapter 6 presents the research findings, conclusions and recommendations for further research.

## 5. DATA ANALYSIS

### 5.1 INTRODUCTION

This chapter discusses the findings of the empirical study in line with the research design in Chapter 3. The study employed a descriptive statistical approach in analyzing the data to establish the variability and levels of association of the data and enabled the study to present the interpretations as a coherent understanding of the research. The findings, analysis and interpretation of the data, collected for the empirical research are presented in this chapter.

The purpose of this chapter is to present the data collected to determine the suitability of elements in the proposed e-learning framework.



**Figure 5-1: Layout of Chapter 5**

The layout of Chapter 5 is represented graphically in Figure 5.1. In Figure 5-1: Section A is the biographical data; Section B presents the understanding of e-learning data and Section C is the evaluation of the proposed framework for e-learning system design data.

## **5.2 RESPONSE RATE**

The sample (as discussed in Section 3.5) consisted of 20 participants of which 7 participants completed the questionnaire satisfactorily. The questionnaire was administered to 20 participants, employed in the field of producing e-learning systems. However, one questionnaire was issued to a company that was no longer involved in e-learning systems development and design. Therefore 19 surveys were considered acceptable for this research. Of the total, 7 questionnaires were returned and considered usable. The response rate was therefore only thirty five percent (35%) which was a significantly low response rate.

The method of data collection was designed with minimal interruption to the participants as explained in the ethical considerations (in Section 3.8) in Chapter 3. Three of the local participants were approached and issued with the questionnaire and the remaining 13 participants received the questionnaire via electronic mail. The advantage of the personal interaction with participants was to achieve more complete responses to the questionnaire and to further probe and solicit responses where the participants experienced difficulty in answering the questionnaire. Valuable discussion emanated from approaching participants to complete the questionnaire increasing the responsiveness towards the e-learning framework. The survey was conducted from 01 November 2012 to 30 November 2012.

The first stage of the research gathering process proceeded with a first notice that was issued to seek permission and inform participants of the intent to conduct the survey. A second email forwarded the covering letter and the consent form which explained: the purpose; importance of the participants and responses; instructions for completion of

the questionnaire; return date; details on completion of the survey and contact details to address concerns or queries. Two weeks thereafter, a third, follow-up email, was sent as a reminder to participants detailing the closing date. Thereafter, a final email was forwarded reminding non-participants to submit the questionnaire. Participants had four weeks to complete the questionnaire thus concluding the data collection process.

### **5.3 PRESENTATION OF DATA**

Analysis of data was represented through column graphs. According to Wellman, Kruger and Mitchell (2005), pie charts and bar diagrams included diagrams in which sections (in the case of pie charts) and columns (in the case of bar diagrams) represented the frequencies of the range of values or scores.

The collection of data included the participant's responses to each question on the questionnaire. A graphical summary of the data was presented and explained in the interpretation. The data analysis was considered in terms of the three sections of the questionnaire, namely:

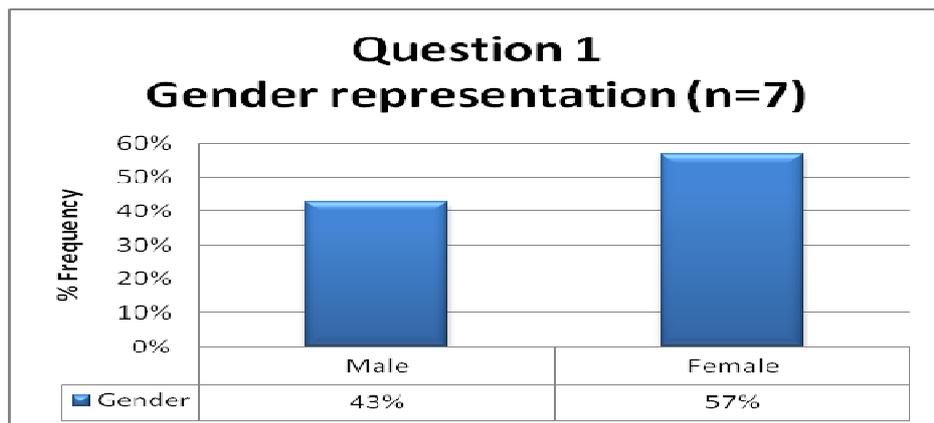
- Section A: Biographical data. The data was collected from responses from Question 1 to Question 4. The context of the data further presented in Section 5.4 was solicited from participants.
- Section B: Understanding e-learning data. Question 5 to Question 9 evaluated the (Section 5.5):
  - Level of understanding of e-learning (Question 5);
  - Usage of an e-learning framework (Question 6 and Question 7) and
  - Role of technology (Question 8 and Question 9).
- Section C: Evaluation of the proposed framework for e-learning system design data. Question 10 to Question 26 addressed the evaluation of the proposed e-learning framework (Section 5.6).

## 5.4 SECTION A- BIOGRAPHICAL DATA AND INFORMATION

Questions 1 to Question 4, in Section A, referred to the biographical information to establish the participant's gender, age, job designation and term of employment. Each of these factors have been analysed and presented below.

- **Question 1: Gender representation**

The gender distribution of participants was examined so as to establish the demographics in the e-learning sector used for this study. The gender profile of the participants was represented as the percentages of the totals per gender as indicated in Figure 5-2. The composition indicated that majority of the participants were fifty seven percent (57%) female and males formed forty three percent (43%) of the total in the group.



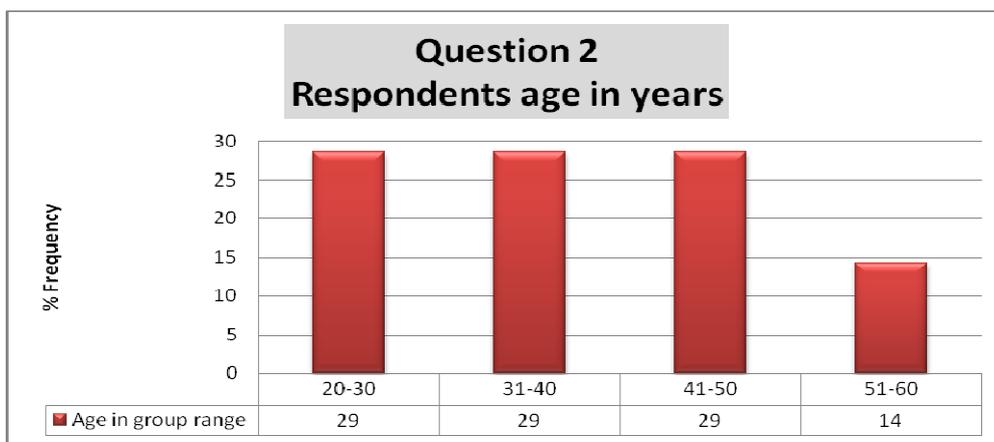
**Figure 5-2: Gender representation**

- **Question 2: Age analysis**

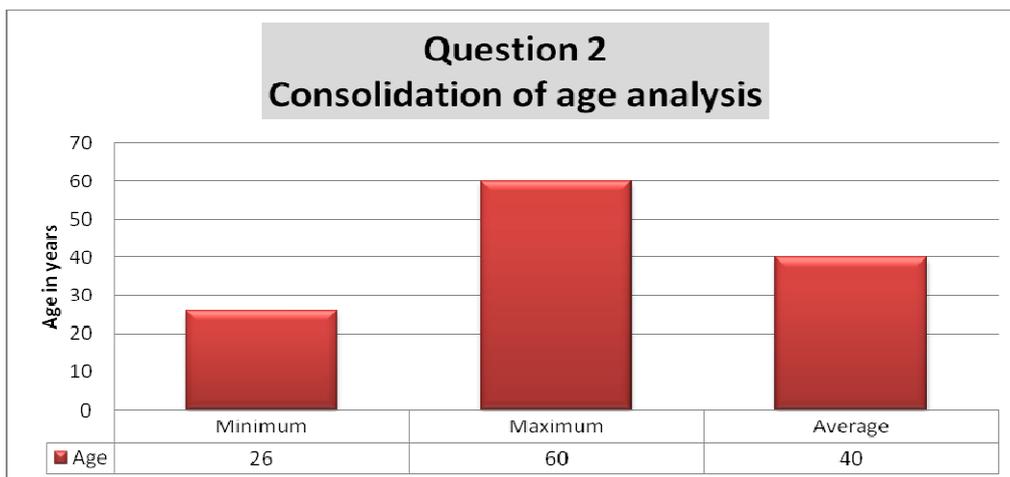
Figure 5-3 (below) summarised the ages of the participants of the study. For the purpose of analysis, the age groupings were introduced in the ranges: twenty to thirty years (20-30); thirty one to forty years (31-40); forty one to fifty years (41-50) and fifty one to sixty years (51-60). The analysis in Figure 5-3 showed that twenty nine percent (29%) were in the '20-30' age group, twenty nine percent (29%) were in the '31-40' age

group and a further twenty nine percent (29%) in the '41-50' age group. The remaining fourteen percent (14%) were classified in the '51-60' age group.

In addition to the analysis of the age groups, the minimum, maximum and average age was calculated. Figure 5-4 below illustrates that the minimum age was twenty six (26) years and the maximum age was sixty (60) years and the average age of the participants was 40 years. The statistics showed a fair representation in terms of age of the participants.



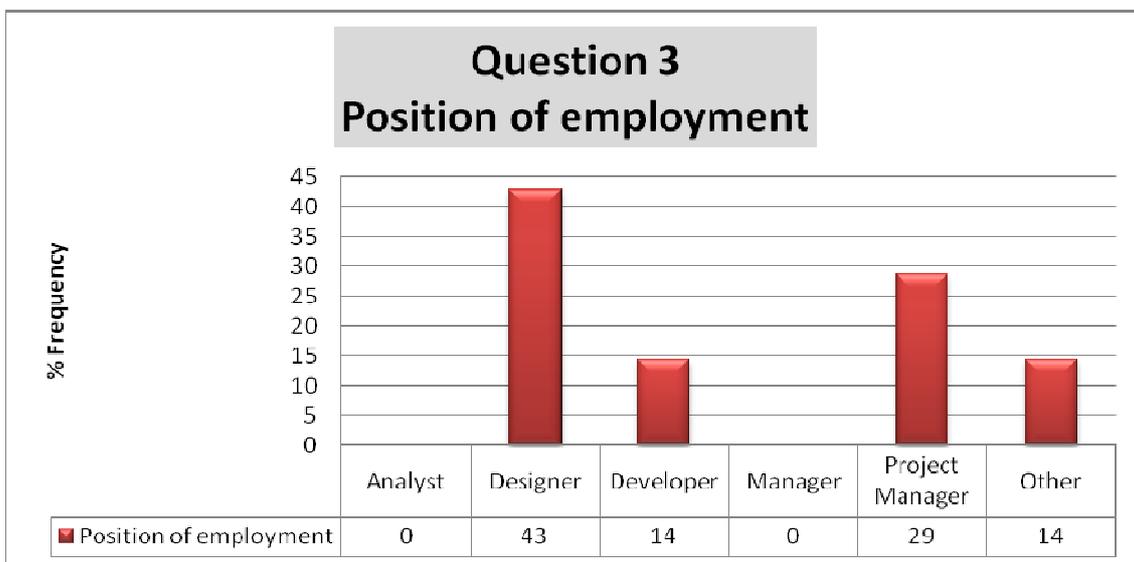
**Figure 5-3: Age of participants**



**Figure 5-4: Consolidation of age in years**

- **Question 3: Position at employment company**

The position of employment in an organization defined the role of the participant based on the involvement in e-learning systems. The results in Figure 5-5 revealed that the majority of the participants i.e. forty three percent (43%) were ‘Designers’, twenty nine percent (29%) were in a project manager role, fourteen percent (14%) were in a development position, and the remaining 14% were classified as ‘other’. No participants indicated that they assumed a position as an analyst or manager. Unfortunately no input was reported from analysts or managers which would have been beneficial, however majority of participants were designers and then project managers in the e-learning field.

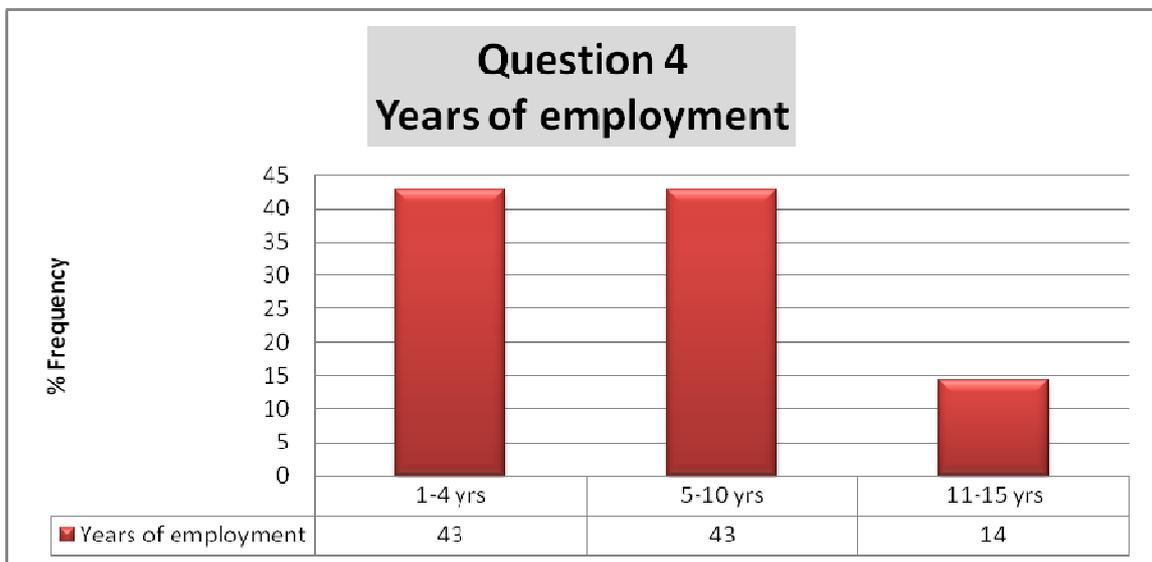


**Figure 5-5: Position of employment**

- **Question 4: Work experience in the organization**

The numbers of years of working experience in an organization was used as an indication of the level of experience of the participants. The data extracted from the questionnaire revealed a balance of years of experience in the design and development fields among the participants. The data was illustrated in Figure 5-6 and grouped in the ranges ‘1-4 years’; ‘5-10 years’ and ‘11-15 years’. The percentages in Figure 5-6

indicated that forty three percent (43%) of the participants in the one to four year range; another forty three percent (43%) in the five to ten year range and fourteen percent (14%) in the eleven to fifteen year range. The employment history showed that participants were employed from a minimum of one year to a maximum of twelve years, with an average of six years of experience amongst the participants. The analysis implied that majority of the participants had served as relevant role players for a length of time in the e-learning field and were likely to provide valuable information based on their expertise.



**Figure 5-6: Years of employment**

### **Summary of Section A**

Considering the above graphical representations in Figures 5-2 to Figure 5-6, it was noted that the higher percentage of participants, were female (50%) and forty three percent (43%) were male, between the ages of twenty (20) and forty (60) years. The employment position of participants included majority designers and project managers. The terms of employment of participants ranged from a minimum of one (1) year to a maximum of twelve (12) years.

In summary of Section A, the analysis of data showed a fair representation of gender, age, terms and positions of employment.

## 5.5 SECTION B – UNDERSTANDING E-LEARNING DATA

This section consisted of five questions on the questionnaire from question five up to and including question nine. The purpose of Section B was to determine:

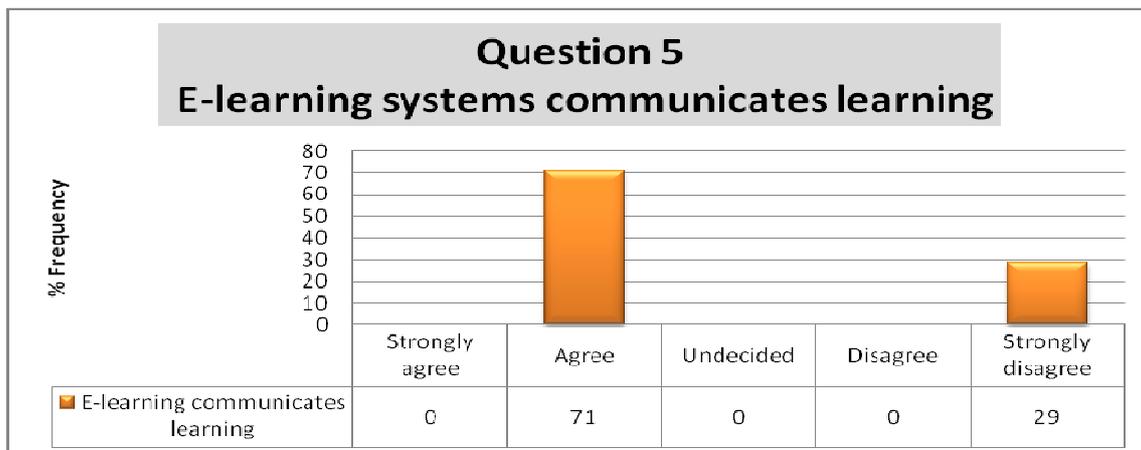
- The level of understanding of e-learning (Question 5);
- The usage of an e-learning framework (Question 6 and Question 7) and
- The role of technology (Question 8 and Question 9).

The participants were required to rate the questions in Section B of the questionnaire according to the Likert scale tabulated from (1) 'strongly agree' to (5) 'strongly disagree'.

### Section B – Question 5 - Rate the following question

- “An e-learning system communicates learning through instruction to promote the transfer of skills.”

This question aimed to ascertain the understanding of an e-learning system in an effort to promote the transfer of learning skills.



**Figure 5-7: Communication of e-learning systems**

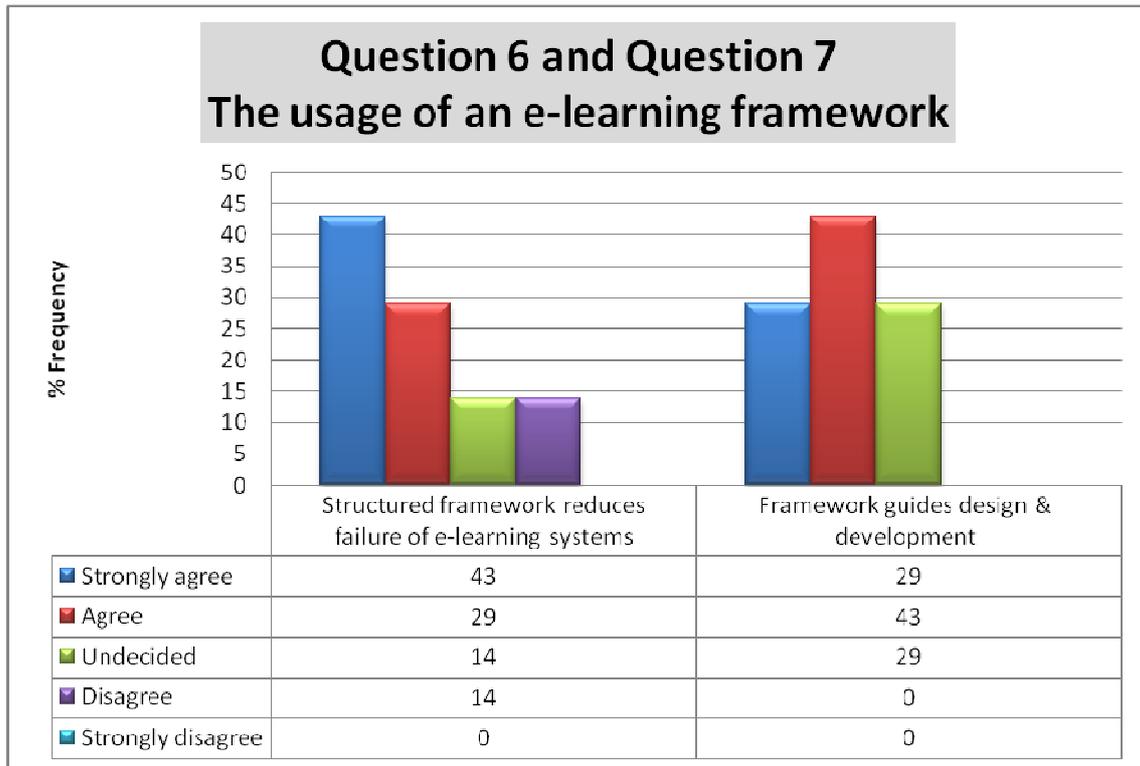
The results of the research for Question 5 are presented in Figure 5-7 above. In response to the question, only twenty nine percent (29%) indicated that they strongly disagreed with the question. Thus they did not believe that e-learning through instruction was necessary to communicate learning to promote skills transfer and did not provide any further comments. With regards to the understanding of the purpose of an e-learning system, seventy one percent (71%) agreed that this was the case.

### **Section B - Question 6 and question 7 – Rate the following question**

- Question 6: “A structured framework for the design of e-learning systems can significantly reduce the failure of e-learning systems.”
- Question 7: “A framework guides the design and development of e-learning systems.”

Both these questions were general questions pertaining to the use of a framework. The summary of the results on the usage of an e-learning framework was determined by question 6 and question 7 as presented in Figure 5-8. The responses varied between forty three percent (43%) of the participants strongly agreed that a structured framework would reduce e-learning system failure, twenty nine (29%) were in agreement with the question; fourteen percent (14%) were undecided and a further fourteen percent (14%) disagreed. The variation in response to this question was noted although the combination of responses in agreement amounted to seventy two percent (72%).

The similarity in response to Question 7, in Figure 5-8, indicated that twenty nine percent (29%) of participants were strongly in agreement and forty three percent (43%) agreed with the question. A total of twenty nine percent (29%) were undecided on whether a framework guided the design and development of an e-learning system.



**Figure 5-8: Usage of an e-learning framework**

**Section B - Question 8 and question 9 – Rate the following question**

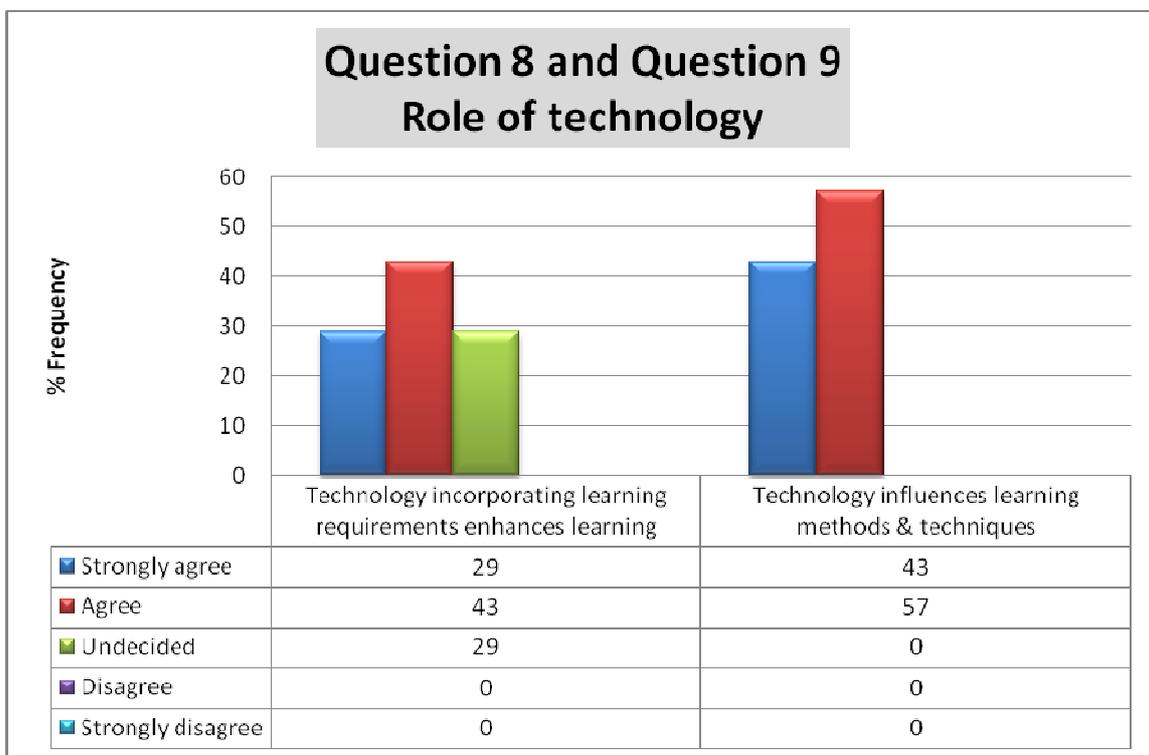
- Question 8: “Technology that incorporates learning requirements can enhance learning.”
- Question 9: “Technology advancements influence the learning methods and techniques in e-learning systems.”

The responses to Question 8 and question 9 related to the role of technology in the e-learning process. The data collected for question 8 and question 9 were analysed using one graph as indicated in Figure 5-9 below.

The analysis for question 8 showed that twenty nine percent (29%) of the participants strongly agreed and forty three percent (43%) agreed that incorporating learning

requirements with technology enhanced learning. Twenty nine percent (29%) of the participants remained undecided.

A consolidated view of the responses for Question 9 revealed that participants were in agreement that technology influenced learning in e-learning systems. Figure 5-9 showed that forty three percent (43%) strongly agreed and fifty seven percent (57%) of the participants agreed with the question.



**Figure 5-9: Role of technology**

**Comments**

After completing Section B, participants were asked to indicate their comments on Question 1 to Question 9. The comments raised from participants at the end of Section B provided further insight into how participants anticipated the progression of e-learning system design.

The comments summarised from participants included:

- Participant 1 identified the need ensuring that learners were kept motivated throughout the contact time within e-learning systems
- From an overall perspective on the topic of understanding e-learning in Section B, Participant 3 highlighted that e-learning systems alone cannot achieve e-learning success. The participant elaborated that the elements: course design; development; management and motivation of the training process were important in the challenge that decisions on procuring e-learning systems were made foremost before the identification of learning needs.
- Participant 4 commented on Question 5 that candidates often struggled with e-learning solutions when systems are implemented from a purely computer based training perspective. In response to Question 6 pertaining to the framework reducing the failure of e-learning systems, the participant indicated that it was often a challenge for learners achieving positive learning outcomes from e-learning system in a move away from traditional instructor led teaching. The participant suggested the combination of trainer led and computer based training that related itself to blended learning.

### **Summary to Section B**

The results from Section B revealed that a high level of knowledge and involvement was required of the participants in the design of e-learning systems. The participants displayed a positive understanding of the e-learning system, the purpose of an e-learning framework and the role of technology on learning and e-learning systems. A greater percentage of participants were in agreement with the questions presented in Section B. The comments provided insight to participants' experience with e-learning systems and emphasized the importance of: keeping learner's motivated and at ease during learning; focus on course design and consideration of learning requirements made prior to acquiring e-learning systems.

## **5.6 SECTION C – EVALUATION OF THE PROPOSED FRAMEWORK FOR E-LEARNING SYSTEM DESIGN**

Section C formed the concluding and central point of focus of the questionnaire by soliciting the participant's views on the proposed e-learning framework proposed in Chapter 4 of this research documentation. In this section the responses to Question 10 to Question 26 was solicited.

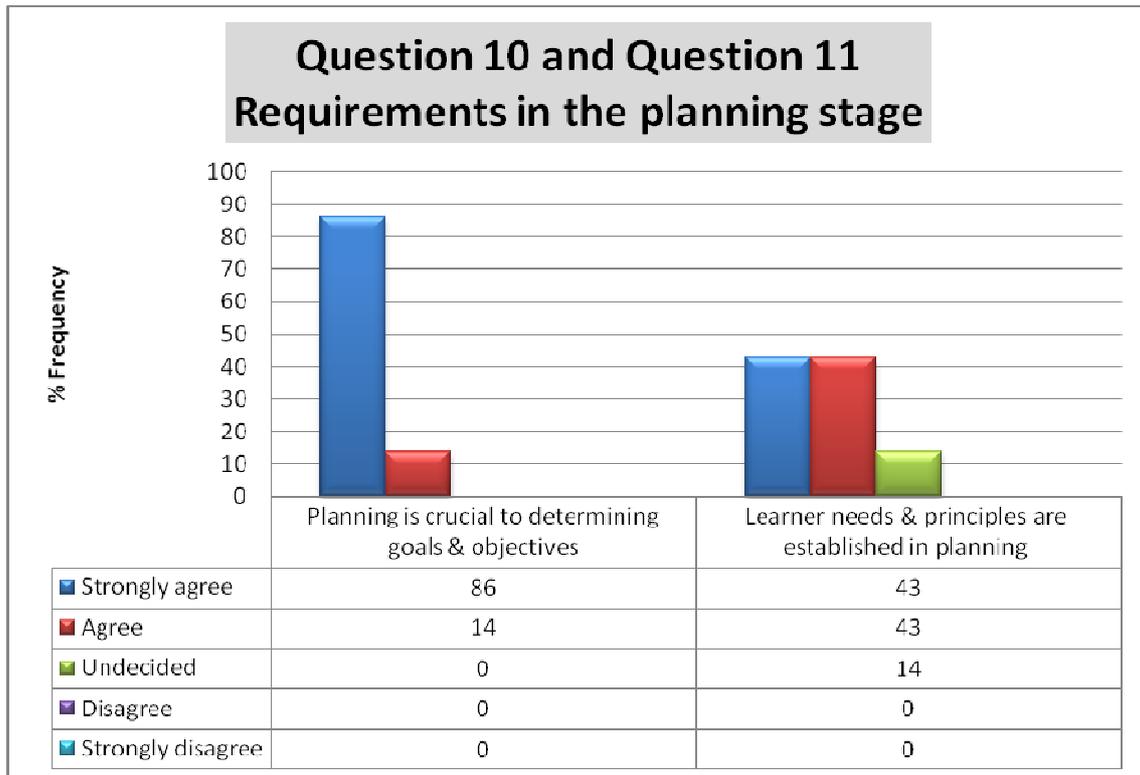
The evaluation and assessment analysis of the proposed framework addressed and discussed the relevance of each stage in the proposed e-learning framework as presented in Figure 1 in the questionnaire (see Appendix C).

**Question 10 and Question 11 pertain to the planning stage of the proposed framework and required the participants to rate the following:**

- Question 10: "The planning stage is crucial in determining the goals and objectives of an e-learning system."
- Question 11: "Specific learner needs and principles are established in the planning stage."

The results on the planning stage shown in Figure 5-10 below, indicated that all participants provided ratings in agreement with the question with eighty six percent (86%) 'strongly agree' and fourteen percent (14%) 'agree'.

Research results for Question 11 revealed that there was an equivalent rating of 'strongly agree' of forty three percent (43%) and forty three percent rated (43%) 'agree' as their choice with fourteen percent (14%) remaining 'undecided'.

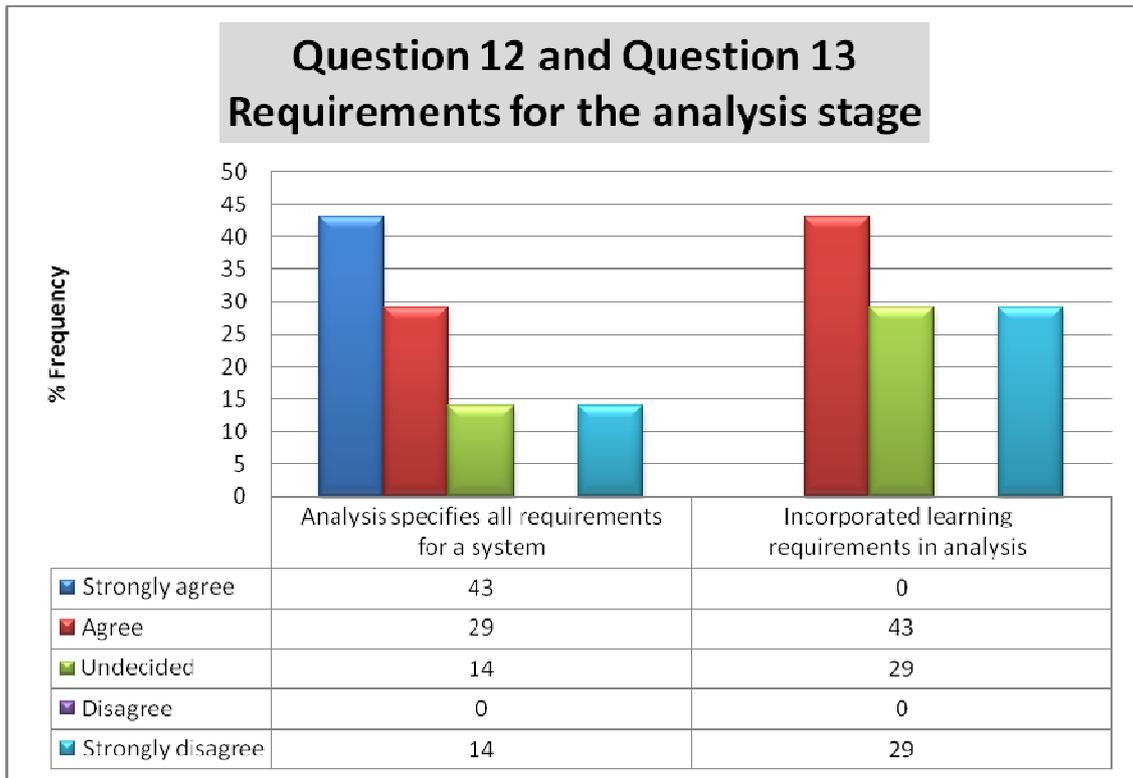


**Figure 5-10: Requirements in the planning stage of the proposed framework**

Therefore, from Question 10 and Question 11, there was consensus that the planning stage was necessary and that the learning needs did form part of the planning stage. This implied that participants displayed an understanding of the importance of the planning stage and the need to outline the goals, objectives, learner needs and learning principles as a starting point for input to the e-learning framework.

**Question 12 and Question 13 pertained to the analysis stage of the proposed framework and required the participants to rate the following:**

- Question 12: “The analysis stage following planning specifies all requirements for an e-learning system. “
- Question 13: “Learning requirements omitted from the planning stage are incorporated in the analysis stage.”



**Figure 5-11: Requirements for the analysis stage of the proposed framework**

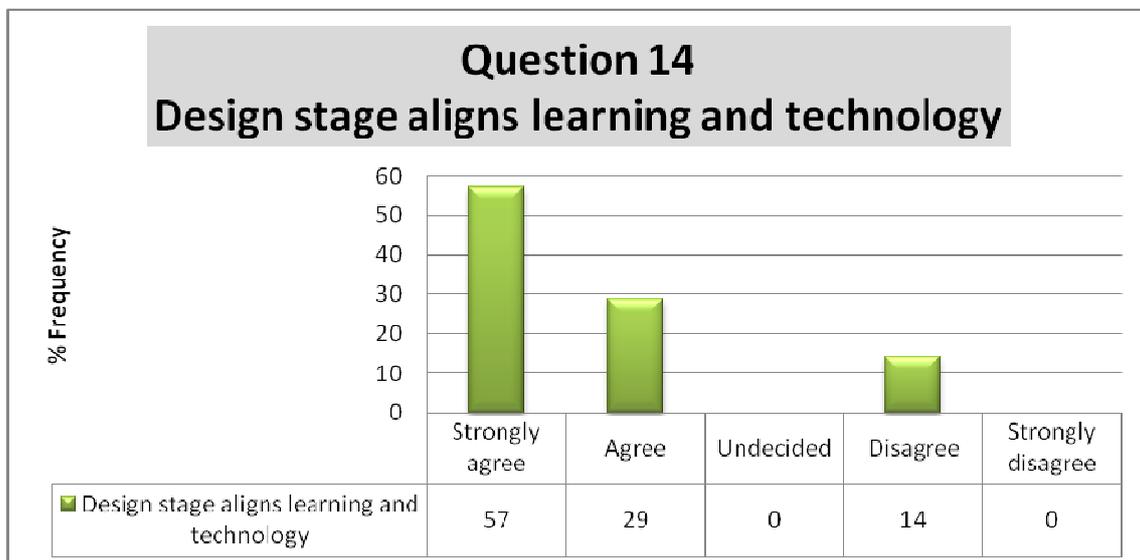
The participant's ratings for Question 12 and Question 13 are illustrated in Figure 5-11 above. In response to Question 12, most participants indicated that they 'strongly agree', i.e. forty three percent (43%) and twenty nine percent (29%) agreed that the analysis phase specified all requirements. Although a consolidation of the 'strongly agree' and 'agree' totals equal to seventy two (72%), fourteen percent (14%) were undecided and a further fourteen percent (14%) rated the question as 'strongly disagree'. The rationale behind the identified need for the analysis stage incorporating all system requirements was a majority of 72% which was a significant input in this instance.

The analysis for Question 13 showed that majority of the participants, i.e. forty three percent (43%) agreed with the question. However, twenty nine percent (29%) were undecided and a further twenty nine percent (29%) 'strongly disagree'. From the graphs above (Figure 5-11), the percentages showed a greater tendency of participants that

agreed with question 12 and question 13 where the analysis phase specified all requirements for a system and further incorporated learning requirements in this phase. The author does acknowledge the comments provided by participants that indicated all learning requirements be outlined in the planning stage and not in the analysis stage as highlighted by the data received.

**Question 14 is relevant to the design stage of the proposed framework and required the participants to rate the following:**

- Question 14: “The design stage is significant to align learning needs with appropriate technology.”

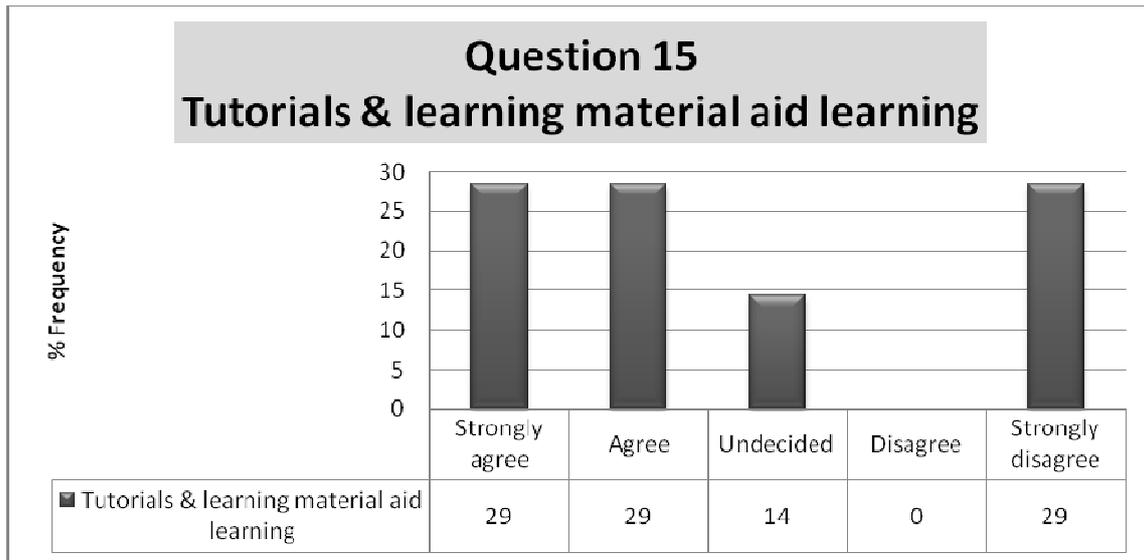


**Figure 5-12: Design stage of the proposed framework**

Responses on the design stage are indicated in the graph (Figure 5-12) above. Most participants indicated a preference to the design stage as the appropriate stage wherein to align learning needs with appropriate technology. Fifty seven percent (57%) rated the question as ‘strongly agree’ and twenty nine percent (29%) indicated that they ‘agree’. A small percentage, i.e. fourteen percent (14%) disagreed with the question. Therefore, the majority believed that in the design stage the learning needs and technology be aligned.

**Question 15 pertained to the development stage of the proposed framework and required participants to rate the following question:**

- Question 15: “In the development stage, tutorials and learning material aid learners to improve their understanding of learning content.”



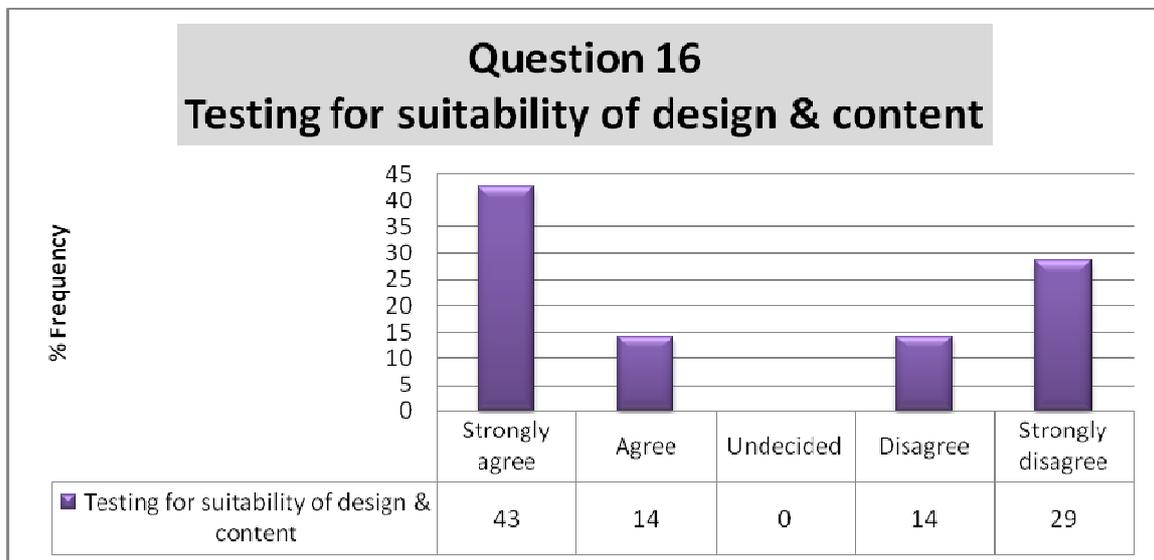
**Figure 5-13: Development stage of the proposed framework**

According to Figure 5-13 above, the statistics revealed an equivalent rating of twenty nine percent (29%) for the ratings: ‘strongly agree’, ‘agree’ and ‘strongly disagree’. A lower fourteen percent (14%) of the participants were ‘undecided’. Overall, a consolidation of results for ‘strongly agree’ and ‘agree’, total fifty eight percent (58%), which was significantly higher than the ratings for ‘undecided’ and ‘strongly disagree’. The results showed that participants overall agreed that the provision of tutorials and learning material assisted learners in increasing their understanding of e-learning content. Participants that agreed with this question suggested the addition of a separate module to this framework which included the learning content, tutorials and learning material.

**Question 16 pertained to the evaluation of the test stage of the proposed framework and required the participants to rate the following question:**

- Question 16: “The testing stage is imperative to test whether the systems design and content is suitable for learning.”

The results of the rating for the question are indicated in Figure 5-14 below. For the purpose of analysis the percentage totals for ‘strongly agree’ and ‘agree’ were combined and the totals for ‘disagree’ and ‘strongly disagree’ were consolidated. Therefore, fifty seven percent (57%) agreed at a higher percentage than the forty three (43%) that disagreed.



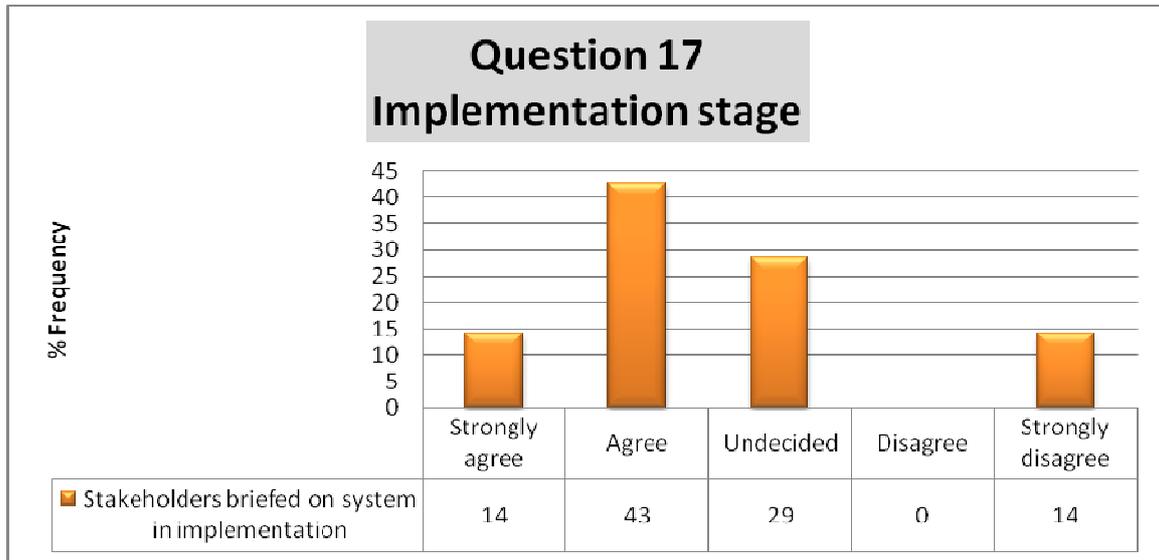
**Figure 5-14: Test stage of the proposed framework**

**Question 17 pertained to the implementation stage of the proposed framework and required the participants to rate the following:**

- Question 17: “During the implementation stage, stakeholders are briefed on the complete e-learning system.”

The result of the ratings of question 17, are presented in Figure 5-15 below. Majority of the participants, i.e. forty three percent (43%) ‘agree’ with the question, followed by

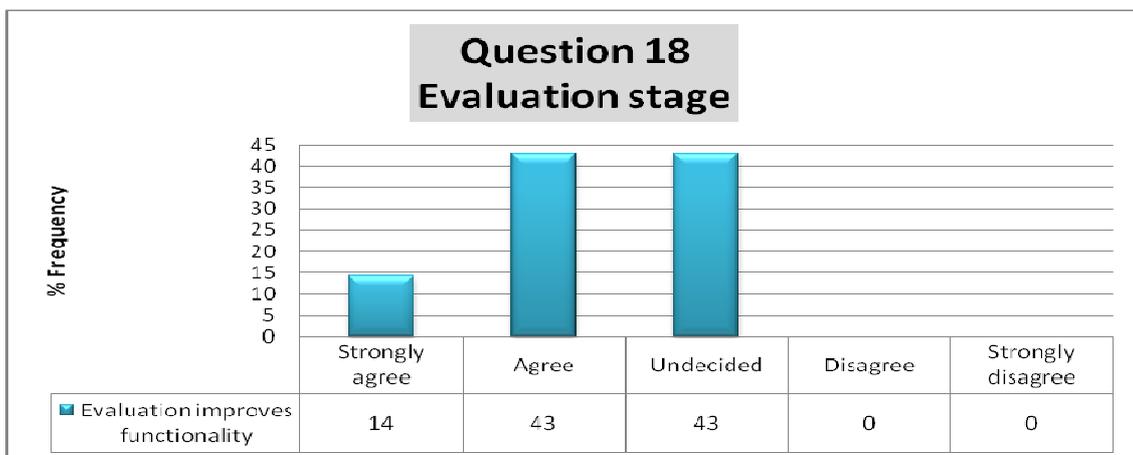
twenty nine percent (29%) that were 'undecided' and an equivalent rating of fourteen percent (14%) each for participants that 'strongly agree' and 'strongly disagree'.



**Figure 5-15: Implementation stage of the proposed framework**

**Question 18 pertained to the evaluation stage of the proposed framework and required the participants to rate the following:**

- Question 18: "The evaluation stage improves the overall functionality of the e-learning system."

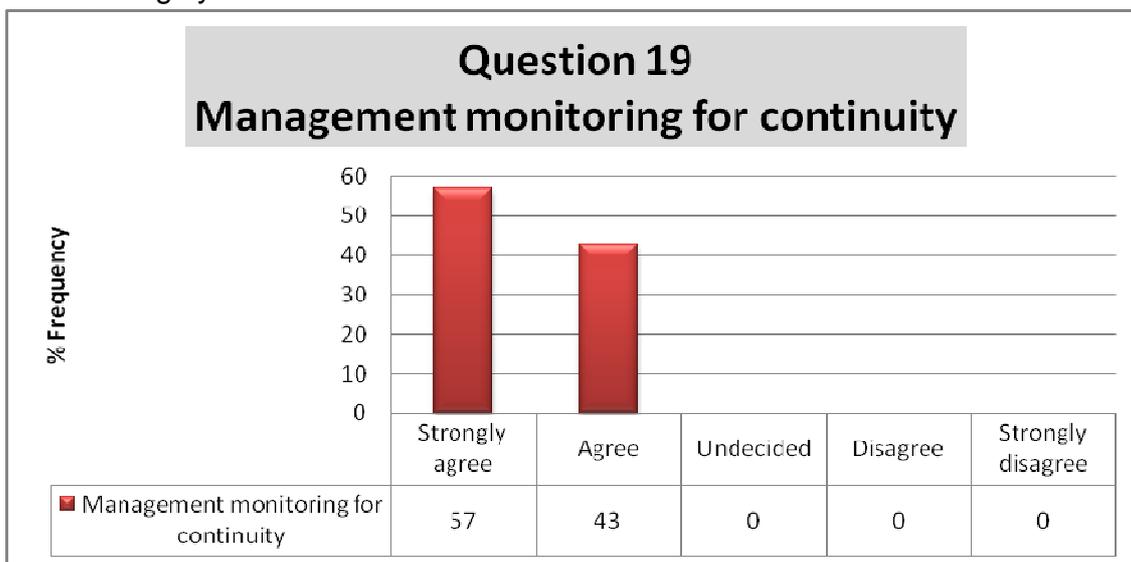


**Figure 5-16: Evaluation stage of the proposed framework**

The ratings of the evaluation stage were indicated in Figure 5-16 above with participant's ratings, i.e. fourteen percent (14%) rated 'strongly agree'; forty three percent (43%) agreeing with the question and forty three percent (43%) were undecided. For the purpose of the analysis, consolidation of the rating, where participants were in agreement, implied that the evaluation stage was necessary for improved functionality of e-learning systems. The ratings 'strongly agree' and 'agree' together made up a majority of responses of fifty seven percent (57%).

**Question 19 pertained to the management functionality of the proposed e-learning framework and required the participants to rate the following:**

- Question 19: "Effective management is needed to monitor the continuity of the e-learning system."



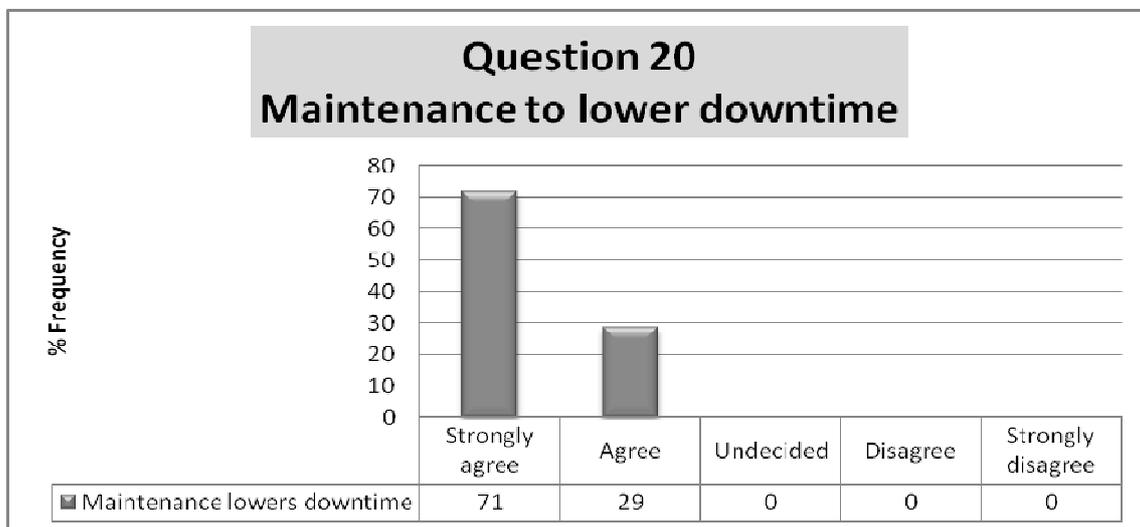
**Figure 5-17: Management monitoring of the proposed framework**

The responses for question 19 are shown in Figure 5-17 above. All participants agreed with the question. Fifty seven percent (57%) rated 'strongly agree' and forty three percent (43%) rated 'agree'. The responses signified consensus from participants that

effective management for monitoring the continuity of an e-learning system was needed.

**Question 20 pertained to the maintenance requirements of the proposed e-learning framework and required the participants to rate the following:**

- Question 20: “A maintenance support function is necessary to minimize system downtime.”



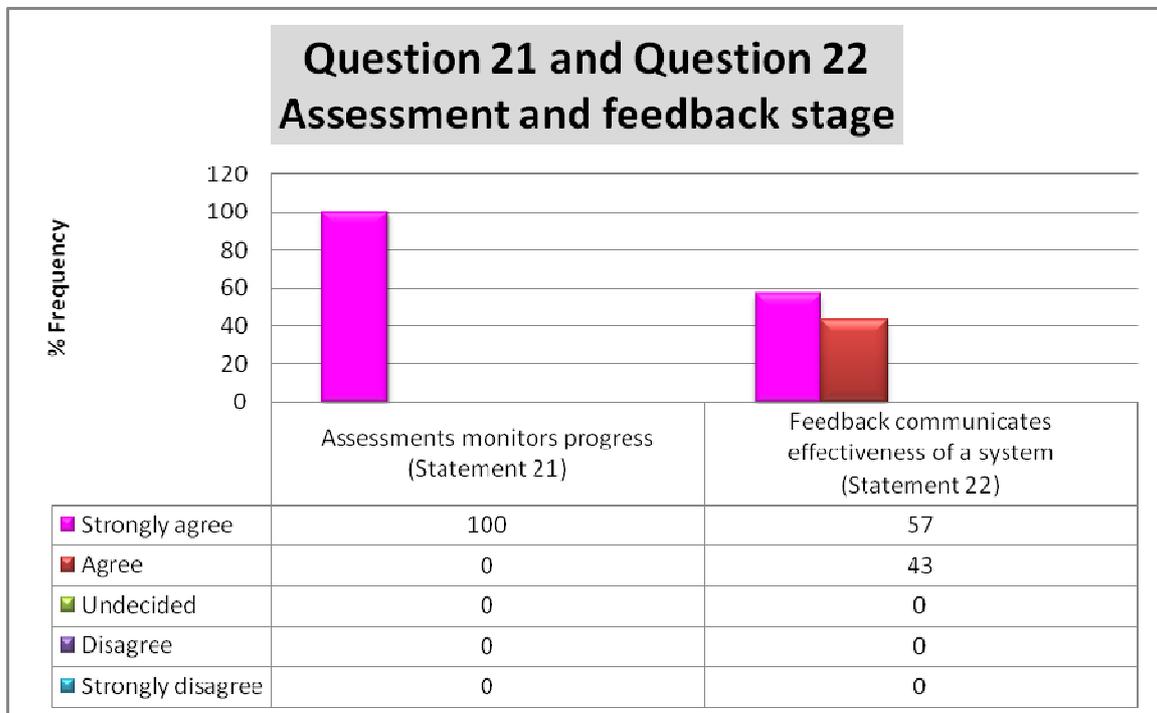
**Figure 5-18: Maintenance stage of the proposed framework**

Responses on the maintenance stage are shown in Figure 5-18 above. Majority of the participants, i.e. seventy one percent (71%) ‘strongly agree’, while twenty nine percent (29%) ‘agree’ with the question. The responses revealed overall that participants agreed that a maintenance function was necessary to minimize downtime.

**Question 21 and question 22 pertain to the assessment and feedback stage in the proposed e-learning framework and required participants to rate the following:**

- Question 21: “Learning assessments is essential to monitor learners progress”

- Question 22: “Feedback provides continuous communication on the effectiveness of the system that may necessitate further system enhancements”



**Figure 5-19: Assessment & feedback stage of the proposed framework**

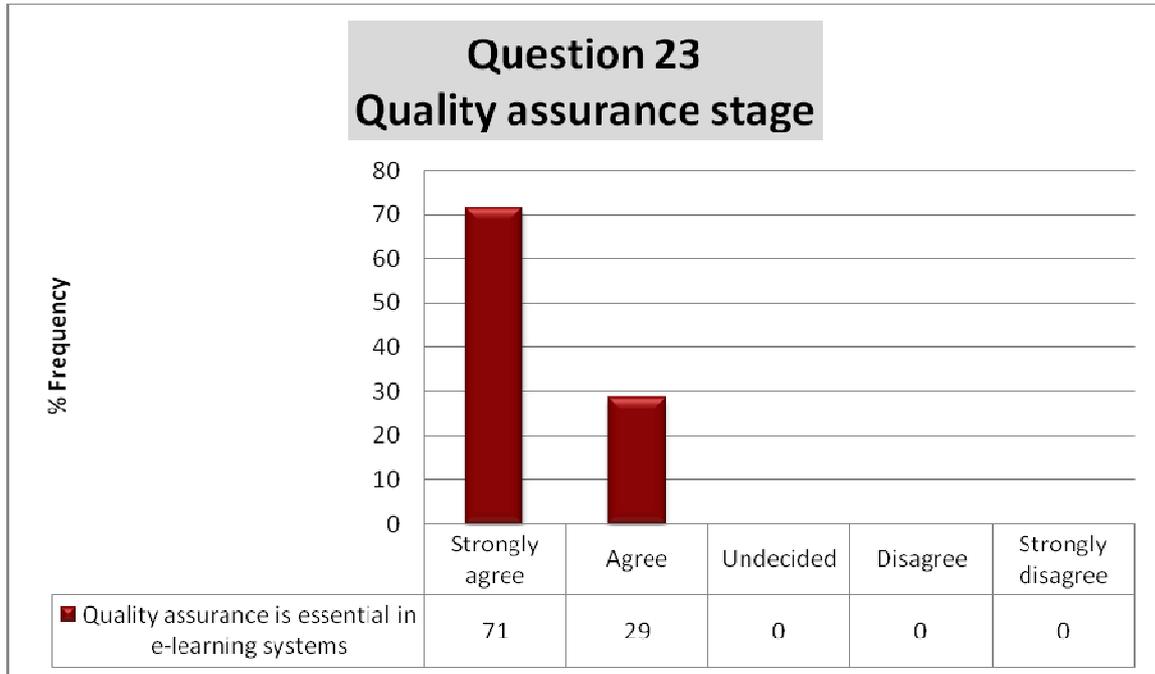
The result of the rating for question 21 and question 22 was illustrated in Figure 5-19 above. The graph represented a one hundred percent (100%) overall rating where participants ‘strongly agree’ that learning assessments were necessary for monitoring learners progress.

Participants also agreed that the feedback stage provided a continuous mechanism of communication which necessitated further system enhancements making the system more effective for learning. Fifty seven percent (57%) strongly agreed and forty three percent (43%) agreed with the question.

The interpretation of the results from Figure 5-19, for question 21 and question 22 revealed the relevance of the assessment and feedback stage in the framework.

Question 23 pertained to the quality assurance stage in the proposed e-learning framework and required the participants to rate the following:

- Question 23: “Quality assurance is essential to maintain credibility of an e-learning system”

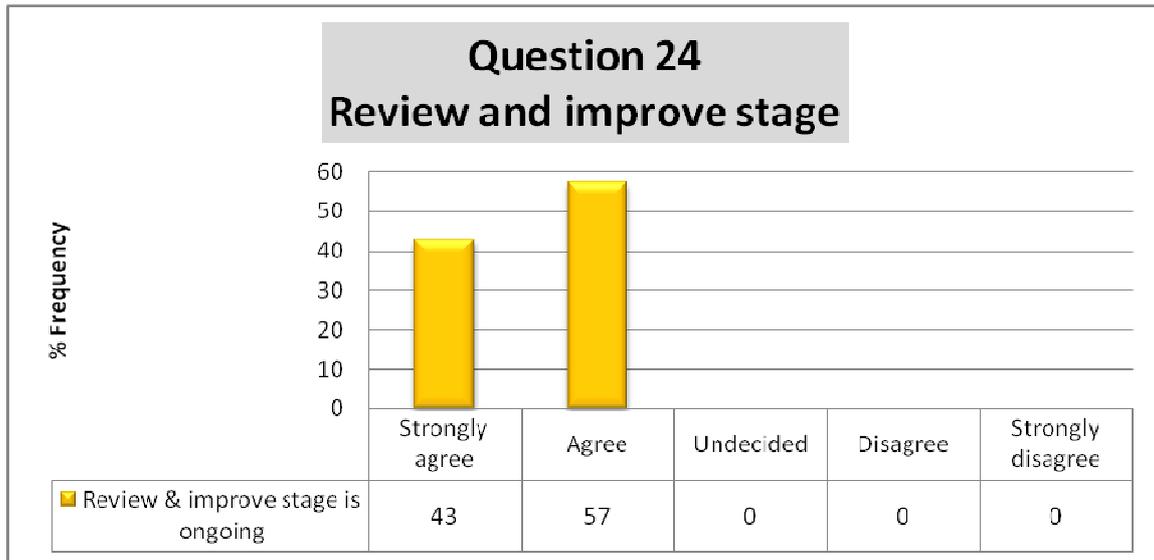


**Figure 5-20: Quality assurance stage of the proposed framework**

The results of the participant’s ratings were indicated in Figure 5-20 above. Majority of the participants rated seventy one percent (71%) as ‘strongly agree’ and twenty nine percent (29%) agreed with the question. The deduction was that the total of all participants agreed that the factor of quality assurance was critical to e-learning systems.

Question 24 pertained to the review and improvement stage in the proposed e-learning framework and required the participants to rate the following:

- Question 24: “The review and improve stage is ongoing to manage changes that need to be made to the e-learning system.”



**Figure 5-21: Review and improve stage of the proposed framework**

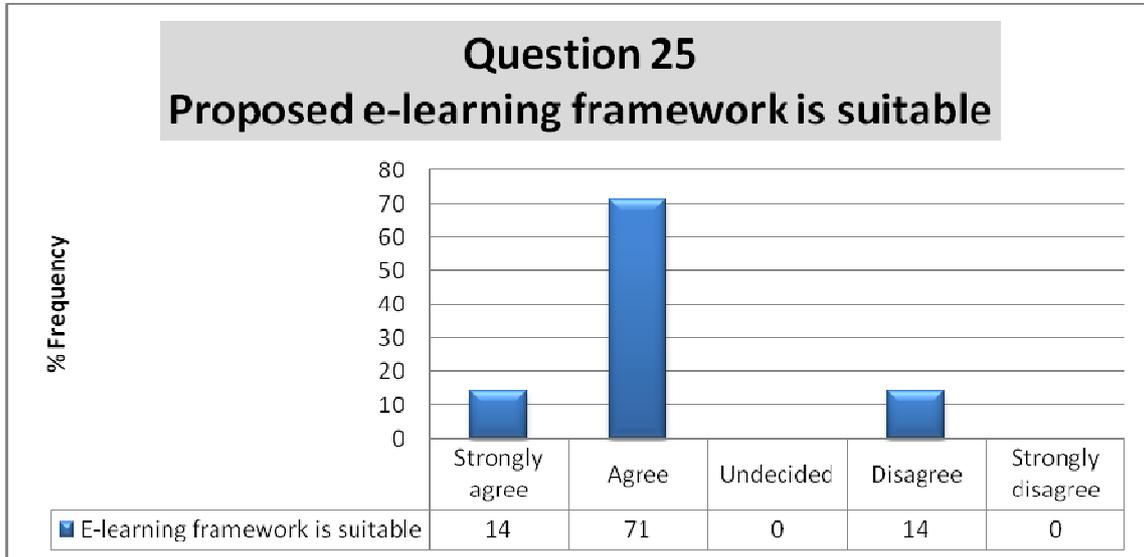
The Figure 5-21 above was representative of the results for question 24. According to participants, forty three percent (43%) selected 'strongly agree' and fifty seven percent (57%) selected 'agree'. All participants agreed that an ongoing review and improve stage was beneficial for tracking and maintaining changes in e-learning systems.

**Question 25 pertained to the proposed e-learning framework and required the participants to rate the suitability of the framework**

- Question 25: 'The proposed e-learning framework provides a suitable approach to the design of e-learning systems.'

The result of Question 25 is indicated in Figure 5-22 below. The majority of participants indicated that the proposed e-learning framework provided a suitable approach to the design of e-learning systems. The responses showed fourteen percent (14%) 'strongly agree'; seventy one percent (71%) 'agree' and a low fourteen percent (14%) 'disagree' with the proposed framework. A consolidation of the totals for 'Agree' and 'Strongly agree' revealed that 85% of the participants agreed with the proposed e-learning framework. Some participants did not 'strongly agree' and explained that the framework needed to be dissected further and all stages are required to have specific outputs and

inputs. The participants therefore affirmed that that the proposed framework was suitable for the design of e-learning systems.



**Figure 5-22: Proposed e-learning framework**

**Question 26 required the participants to state concerns or make comments on the proposed e-learning framework or questions in the questionnaire:**

- Question 26: “List any objections or comments you may have with the overall framework or any part thereof.”

The responses for Question 26 in Section C noted comments where specific reference was made to the proposed e-learning framework. In the responses to this question, participants commented on the overall proposed e-learning framework or the specific stages in the proposed framework.

- Participant 1 provided comments and recommended that the proposed framework be simplified further to detail stakeholders and parameters. The participant agreed that the proposed framework was potentially effective in to the design of e-learning systems and specific detail into the stages would be welcomed.

- Participant 2 commented on the analysis phase in Question 13 in particular stating that the specific learning needs be determined primarily in the analysis phase and requirements for systems meeting learning needs be detailed in the design phase.
- In response to Question 15, Question 21 and the overall proposed framework, Participant 3 indicated the importance for e-learning systems managing e-learning content and assessments independently to the process of developing and procuring e-learning systems.
- Participant 4 provided comments on Question 13, Question 16 and Question 17. In response to Question 13 the participant stated that carefully incorporating all learning needs in the planning stage minimized and prevented changes to the system at a later stage as a result of additional or changed learning needs. The comments on Question 16 indicated that the suitability of learning content be confirmed in the planning phase while the testing stage assessed the functionality of the system. Through experience and involvement with e-learning systems, Participant 4 indicated the importance of engaging stakeholders from the point of inception of the e-learning system highlighting that the failure of systems were often as a result of delayed stakeholder involvement and contribution to e-learning systems.
- Nil comments received from Participant 5 and Participant 6.
- Participant 7 indicated that user friendly interfaces were imperative for e-learning systems.

The author noted the participants negative comments as valid with a view to address the comments in future work as highlighted in Chapter 6. The comments included:

- The proposed e-learning framework needed to be further simplified and all parameters and stakeholder roles to be explained in detail.
- The reference to e-learning content and assessment needed to be managed separately to that of developing and procuring an e-learning system.

### **Summary to Section C:**

Section C presented the findings on the views of the proposed e-learning framework. The aim was assessing the relevance of each stage individually. The responses were solicited from questions ten (10) up to and included question twenty six (26).

Consensus in the planning stage showed that all participants understood and agreed on the importance of the planning stage. Views on the analysis stage indicated that forty three percent (43%) and twenty nine percent (29%) 'strongly agree' and 'agree' respectively that the analysis stage needed to specify all requirements for an e-learning system with fourteen percent (14%) remaining undecided and fourteen percent (14%) disagreeing with the question. Variations in the responses indicated that forty three percent (43%) agreed that learning requirements were included in the analysis stage with twenty nine percent (29%) 'undecided' and twenty nine percent (29%) 'disagree'.

In the design stage, participants (a consolidated eighty six percent) agreed that the stage was necessary for aligned learning needs with technology, whereas fourteen percent (14%) disagreed. The development stage included the facilitation of tutorials and learning material revealed varied rating with a consolidated fifty eight percent (58%) in agreement and fourteen percent (14%) undecided and twenty nine (29%) 'strongly disagree'. The results of the ratings for the testing stage were combined for 'strongly agree' and 'agree' totaling fifty seven percent (57%) whilst the consolidation of results for 'strongly disagree' and 'disagree' equaled forty three percent (43%).

The results in the implementation stage indicated that twenty nine percent were 'undecided', a combination of 'strongly agree and 'agree' equaled fifty seven percent (57%) and fourteen percent (14%) strongly disagreed with the question that stakeholders are briefed in the implementation stage. A combined total of fifty seven percent (57%) indicated that participants agreed that the evaluation stage improved functionality whereas forty three percent (43%) were 'undecided'.

There was consensus from all participants that: monitoring by management; the maintenance stage and assessment were essential for continuous running of e-learning systems. Although only fifty seven percent (57%) felt that feedback made the system more effective and forty three percent (43%) were 'undecided'. All participants agreed that the quality assurance stage and review and improve stage were essential to maintain the credibility of e-learning systems.

In a holistic view, a combined total of eighty five percent (85%) of participants agreed that the proposed e-learning framework was suitable with a low fourteen percent (14%) disagreeing with the question.

<b>Table 5-1 Summary of responses from the questionnaire (Summarised by the author)</b>		
<b>Questions extracted from the questionnaire</b>		<b>High level analysis of the participant's responses</b>
<b>Section A – the purpose of this section was to collect biographical information, such as : gender; age; job titles and to establish the number of years participants had served in their employment</b>		
<b>1</b>	Indicate your gender	The analysis of the data showed that 57% of the participants were female and 43% were male at an average age of 40 years
<b>2</b>	Indicate your age in years	The minimum age was 26 years with the maximum of 60 years
<b>3</b>	The position you are employed in your organization	Overall 29% of the sample group was in a development environment, with a further 29% in management positions. The remaining 43% were classified as 'other', but also pertained to a management role in some way.
<b>4</b>	How long have you been employed at your organization?	The employment history showed that participants were employed from a minimum of one year to a maximum of 12 years, with an average of 6 years experience amongst the group.
<b>Section B – the purpose of this section was to establish: the level of understanding of e-learning; the role of technology and the usage of an e-learning framework. Participants ratings were recorded on the Likert scale</b>		
<b>5</b>	An e-learning system communicates learning	Seventy one percent (71%) of the

**Table 5-1 Summary of responses from the questionnaire  
(Summarised by the author)**

<b>Questions extracted from the questionnaire</b>		<b>High level analysis of the participant's responses</b>
	through instruction to promote the transfer of skills	participants agreed that e-learning communicated learning and promoted the transfer of skills. The remaining twenty one percent (21%) disagreed with the statement.
<b>6</b>	A structured framework for the design of e-learning systems can significantly reduce the failure of e-learning systems	The responses varied with seventy two percent (72%) of participants agreeing with the statement, fourteen percent (14%) were undecided and a further fourteen percent (14%) disagreed.
<b>7</b>	A framework guides the design and development of e-learning systems	A greater seventy two percent (72%), preferred the development of an e-learning system through a framework, whereas twenty nine (29%) were undecided.
<b>8</b>	Technology that incorporates learning requirements can enhance learning	Seventy two (72%) of the participants agreed with the statement, with twenty nine percent (29%) remaining undecided.
<b>9</b>	Technology advancements influence the learning methods and techniques in e-learning systems	Participants were in one hundred percent (100%) agreement with the statement that technology influenced learning in e-learning systems.
<b>Section C – the purpose is to assess the stages of the proposed e-learning framework</b>		
<b>10</b>	The planning stage is crucial in determining the goals and objectives of an e-learning system	Participants were in one hundred percent (100%) agreement that the planning stage was critical
<b>11</b>	Specific learner needs and principles are established in the planning stage	Eighty six percent (86%) of the participants agreed with the statement and fourteen percent (14%) were undecided.
<b>12</b>	The analysis stage following planning specifies all requirements for an e-learning system	The responses ranged from seventy two percent (72%) of the participants in agreement, fourteen percent (14%) undecided and fourteen percent (14%) disagreeing with the statement.,
<b>13</b>	Learning requirements omitted from the planning stage are incorporated in the analysis stage	Although forty three percent (43%) of the participants agreed with the statement, twenty nine (29%) were undecided and the remaining twenty nine (29%) disagreed that omitted requirements be included in

**Table 5-1 Summary of responses from the questionnaire  
(Summarised by the author)**

Questions extracted from the questionnaire		High level analysis of the participant's responses
		analysis.
14	The design stage is significant to align learning needs with appropriate technology	Majority of participants totaling eighty six percent (86%) agreed with the statement whereas fourteen percent (14%) disagreed.
15	In the development stage, tutorials and learning material aid learners to improve their understanding of learning content	A range of responses in this question included, fifty eight percent (58%) of participants that were in agreement, twenty nine percent (29%) disagreed and the remaining fourteen percent (14 %) were undecided.
16	The testing stage is imperative to test whether the systems design and content is suitable for learning	The responses were relatively close with fifty seven percent (57%) in agreement and forty three percent (43%) disagreeing with the statements. Some participants commented that testing be assessed only if the system was in proper working order.
17	During the implementation stage, stakeholders are briefed on the complete e-learning system	Fifty seven percent (57%) of the participants agreed with the statement, with twenty nine (29%) undecided and fourteen percent (14%) in disagreement.
18	The evaluation stage improves the overall functionality of the e-learning system	In the evaluation stage, fifty seven percent (57%) of participants agreed, with a large forty three percent (43%) undecided if the evaluation stage improved functionality.
19	Effective management is needed to monitor the continuity of the e-learning system	All participants agreed that management was needed for monitoring the continuity of systems.
20	A maintenance support function is necessary to minimize system downtime	All participants agreed with the statement to keep the system at an optimum rate.
21	Learning assessments is essential to monitor learners progress	All participants agreed that learning assessments was essential
22	Feedback provides continuous communication on the effectiveness of the system that may necessitate further system enhancements	All participants agreed with the statement
23	Quality assurance is essential to maintain credibility of an e-learning system	All participants agreed with the statement
24	The review and improve stage is ongoing to	All participants agreed with the statement

<b>Table 5-1 Summary of responses from the questionnaire (Summarised by the author)</b>		
<b>Questions extracted from the questionnaire</b>		<b>High level analysis of the participant's responses</b>
	manage changes that need to be made to the e-learning system	
25	The proposed e-learning framework provides a suitable approach to the design of e-learning systems	Eighty five (85%) of the participants agreed that the framework was suitable with fourteen percent (14 %) in disagreement due to the emphasis on content and assessments. The participant suggested that content and assessment be treated as separate requirements in the framework.
26	List any objections or comments you may with the overall framework or any part thereof	In summary, participants stressed that the system be user friendly and all requirements incorporated in the planning stage. Another comment was that the framework provided further classifications and explanations for each stage.

The comments received in Section 5.5 and Section 5.6 from participants was further analysed in line with the suggested future improvements to the e-learning framework.

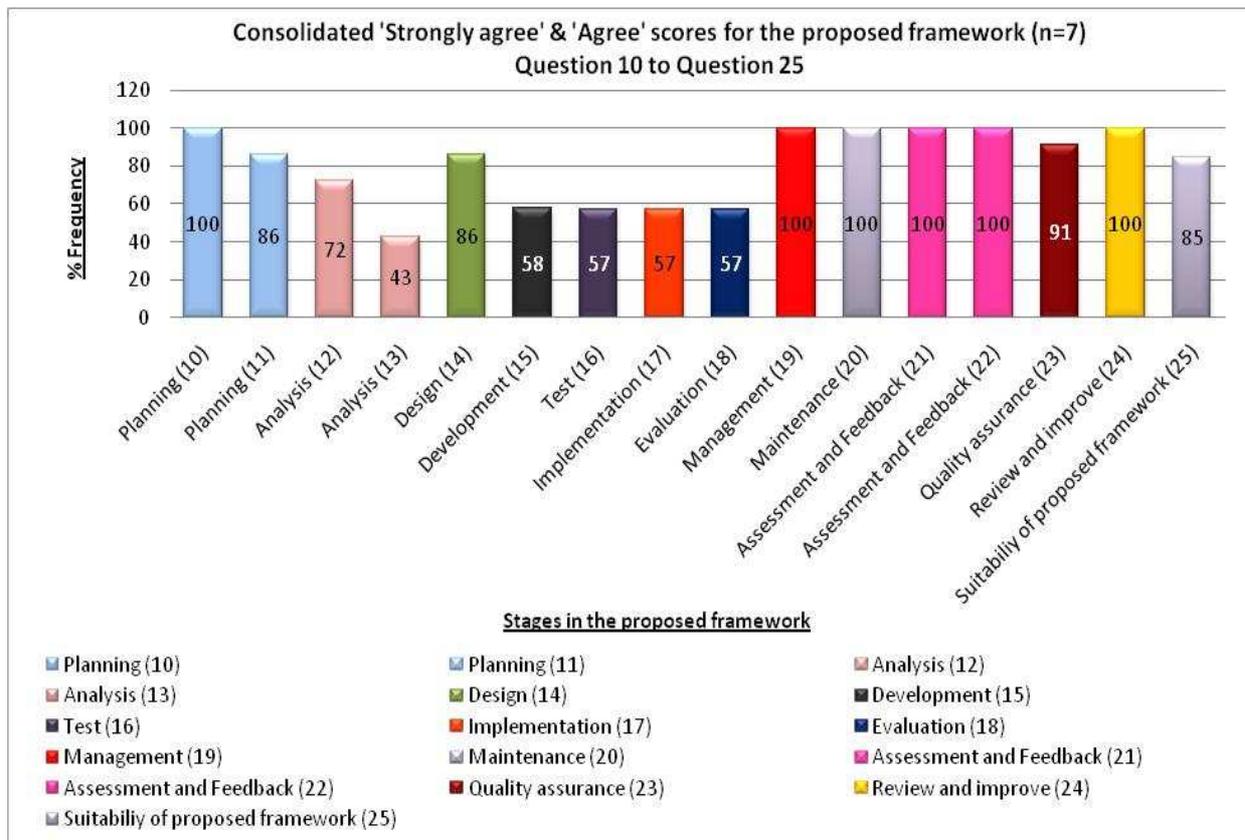
From the comments made by participants the following improvements were suggested and proposed to the proposed framework.

The phases in the proposed framework ought to be expanded further to include a breakdown and detailed specification into the parameters of each stage. Essentially, a detailed input and output plan is to be included to present the specific requirements for each stage of the proposed framework including the detailed roles of stakeholders. The advantage would therefore be derived by preventing overlapping of the functions of each stage in the proposed framework. Therefore, the learning requirements be clearly defined and incorporated thoroughly so there is no extension of the scope of the system in the event of changing or adding learning requirements at a later stage.

The recommendation that the e-learning content and assessments be handled out of the system requires further analysis and research. Although the participant's comments

stressed on separating content and assessment to development, the proposed framework aimed to incorporate the learning material content into the system during development with the provision of keeping the content updated through the review and improve dimension. The aim of the framework was also to maintain continuity of the system and presented updated learning material that was relevant to educational requirements.

The framework was structured preventing the possibility of designing e-learning systems first and structuring the content to suit the system. The framework took into consideration the importance of captivating the learner’s attention and interest and keeping them motivated, ensuring a seamless learning environment. The graph below (Figure 5-23) shows the consolidated rating for ‘Strongly agree’ and ‘Agree’ for the proposed framework with specific reference from Question 10 to Question 25 which finds favourable ratings in majority of the questions.



**Figure 5-23: Consolidated positive rating on the proposed framework**

The proposed e-learning framework was conceptualised and developed from the initial stages of the learning processes in mind and dwelled on the continuity of learning through a structured, systematic approach. The benefit of the proposed framework as depicted in Figure 4-2 (Section 4.2) ensured that pedagogy elements were included throughout the proposed e-learning framework. The design of the proposed e-learning framework emphasised the importance of each stage in the framework holistically addressing pedagogical requirements and learning principles. The detail of each of the stages supported the proposed framework, lending itself to the monitoring and managing of the e-learning system catering for changes in learning curriculums and learning patterns.

The advantage of the proposed framework was the flexibility for reviewing, improving and managing changes influenced by learning requirements. Although the core of the proposed framework was identified through a top down approach, the review and improve stage was critical in identifying and managing changes that were likely to occur. The active involvement of stakeholders was highlighted from inception of the system meeting the goals and objectives for the desired learning outcomes. The proposed framework considered the strength of stakeholders and required continuous input through the framework. The emphasis of the proposed framework culminated structure establishing and meeting the e-learning and technology goals and outcomes. The proposed framework detailed the inputs and desired outputs per stage indicative of requirements for each stage incorporating pedagogy requirements. The proposed framework took cognisance of learning needs during the conceptualisation of e-learning systems and not after the system was implemented. The idea behind the framework was to produce e-learning systems incorporating learning needs at the onset, monitor and review the system in the event that pedagogy requirements changed. The involvement of technology played an important role communicating learning and specifically meeting pedagogy requirements pitched at varying learning levels with the flexibility of reviewing and improving outputs in the process with minimal disruptions.

From the analysis in Section C, it can be deduced that the proposed e-learning framework was potentially effective to the design of e-learning systems. The participant's comments as detailed in the questionnaires suggested that minimal improvements be instituted on the framework. The favorable output of the participants ratings are reflected in Figure 5-23 above.

## **5.7 CONCLUSION TO CHAPTER 5**

This chapter presented the findings from the survey conducted among e-learning role players. Section A provided the study with the biographical data of the participants. The data analysis presented in this chapter, particularly from Section B and Section C addressed the questions posed in research question of this study. Participants rated all stages in the proposed e-learning framework and provided valuable comments that were detailed in the analysis. The summary of responses particularly emanating from Section C, were represented in the graph in Figure 5-23. The statistics revealed eighty five percent (85%) of the participants agreed that the proposed e-learning framework was suitable for the design of an e-learning system. This chapter provided the basis on which conclusions and recommendations will be presented in the final chapter (Chapter 6).

The final Chapter 6 concludes the study and discusses the findings from the analysis of the survey, among e-learning role players.

## **6. ACHIEVEMENTS, FINDINGS, RECOMMENDATIONS AND CONCLUSIONS**

### **6.1 INTRODUCTION**

The previous chapter concentrated on the analysis and presentation of data. This chapter presents a summary of the achievements of this study in Section 6.2. Section 6.3 presents the conclusions that may be drawn on the findings of the research in response to the research questions, as posed in Chapter 1. Section 6.4 provides an explanation on the recommendations for future research. The conclusion to the study is provided in Section 6.5.

### **6.2 WHAT HAS BEEN ACHIEVED IN THE STUDY**

The central focus of this study was the proposal of a pedagogic e-learning framework for the design and development of e-learning systems. Although existing e-learning frameworks were identified and analysed in the literature, the theoretical component of this study presented the importance of a consolidated, practical framework to focus on incorporating pedagogy requirements in the proposed e-learning framework. In addition to the analysis of the existing e-learning frameworks, the pedagogical factors were surveyed to establish important factors applicable for the design and development of e-learning systems. The research questions presented in Chapter 1 and the literature study in Chapter 2 guided the development of the proposed e-learning system framework. The proposed pedagogic e-learning framework was described in Chapter 4 in terms of the dimensions, stages, and the inputs and outputs that were relevant to each stage (see Appendix C).

The empirical research explained in Chapter 3 was conducted using a survey where participants completed questionnaires that pertained to the evaluation of the proposed e-learning framework. The administration of the survey was preceded by a pilot study. The research design described the approach for implementing the practical component of this study which was conducted over a period of one month. The participants identified as role players in the development of e-learning systems were analysts,

designers, developers, projects managers and executive members of management in local and international organizations from local and international organisations that were involved in the design, development or management process concerning e-learning systems development and design.

The quantitative data collected through the survey was analysed and presented in Chapter 5 in line with the research design that was presented in Chapter 3. The data was presented through column graphs which were representative of the frequencies of the range of values and scores.

A proposed article is noted as Appendix E.

The intention is to submit the article to the next Ed-Media conference.

An integrated and enhanced understanding of an e-learning system, the purpose of an e-learning framework and the role of technology on e-learning systems was achieved. Participants responded favorably to the proposed e-learning framework and highlighted the benefit of achieving longevity of e-learning systems.

### **6.3 FINDINGS – ANSWER TO THE RESEARCH QUESTIONS**

The overall purpose of the study was to propose a pedagogic e-learning framework to facilitate the design and development of e-learning systems. The research was structured by the objectives and the research questions that were detailed in Chapters 1 and 2. The following objectives were identified to establish answers to the research problem.

The first objective was to conduct a literature study to gain relevant insight to the Research Questions 1, 2 and 3 that led to the development of the proposed e-learning framework. The research questions are:

- Research Question 1 - What is the current state of the art of e-learning in defining the e-learning concept and its relevance to learning and technology? There was no conclusive e-learning definition that explained the synergy

between pedagogy, technology and the communication of e-learning. Taking the definitions into account the author presented a consolidated e-learning definition that was relevant to this study and contributed to the development of the proposed e-learning framework.

- Research Question 2 - What is the role and impact of technology in the e-learning environment? The second question identified the effect of technology on learning for e-learning interventions. The research was relevant to incorporate pedagogy elements communicated through technology particularly at each stage in the proposed framework.
- Research Question 3 - What frameworks and pedagogy principles currently exist to guide e-learning systems design and development? The third question determined the extent to which the frameworks in the literature study considered pedagogy elements and learning needs as essential factors in the design of e-learning systems. This study understood the lack of a conclusive, consolidated e-learning framework. The summary of the frameworks compiled by the author indicated that there were varying interpretations of what constituted the appropriate e-learning framework.

The second objective was to propose a pedagogy-centered e-learning framework used as a baseline for the design and development of e-learning systems that was relevant to Research Question 4.

Question 4 – What is an appropriate framework and its contributing elements to develop and enhance the design of e-learning systems for learning and technology? The framework was proposed in Chapter 4 of this study to holistically support the communication of e-learning through technology. The appropriate detail was highlighted through each dimension and corresponding stage of the proposed e-learning framework with specific reference to the pedagogy elements.

The last objective was to ensure that the proposed e-learning system framework was validated against the last research question.

Research Question 5 - Does the use of the proposed e-learning systems framework contribute to the design of an e-learning system? The research question was investigated by conducting a survey of a selected group of participants. A pilot study of the questionnaire was carried out prior to engaging participants for research. The role of technology in the proposed e-learning framework was assessed in the survey and showed significant focus be thrust upon technological requirements from the initial stage. The results of the analysis revealed that a large majority of participants were in favor of the structure and agreed with the logic of the dimensions and stages in the proposed framework as depicted in Figure 4-2. In Chapter 5, a detailed analysis summary of the responses specific to each stage of the proposed e-learning framework was depicted in Figure 5-23. This figure showed the relevance of the elements. This guided the assessment of the appropriateness of the proposed e-learning framework. The overall view was that the proposed framework was a suitable approach for the design of e-learning systems.

#### **6.4 LIMITATIONS**

Further to the limitations for this research given in Section 1.8.2, the following limitations restricted the research findings:

- The research was conducted only amongst role players understood to be involved in the development of e-learning systems. This returned a low response to the survey.
- The sample of twenty (20) participants were limited as a result of a search on existing local and international service providers of e-learning systems. Furthermore, only seven participants provided data for the analysis of this study.
- The proposed e-learning framework was presented to participants during the survey with limited detail to substantiate the content in each stage in the framework. This was a limitation as participants had a narrow view of the logic and reasoning behind the stages included in the proposed framework and requested further detail into the stages of the proposed framework.

- The proposed e-learning framework derived in Chapter 4 was the basis for this research conducted in the survey. Overall, the participants provided positive feedback to the proposed framework, however certain suggested improvements were recommended. Learning needed to be established in the planning phase and not in the analysis stage, the learning content and assessments needed to be managed separately to procuring e-learning systems, the stakeholder's involvement and expectations managed from the initial stages and the system maintained a user friendly interface. These suggestions were noted and planned to be included in the next version of the proposed e-learning framework which will be evaluated and improved upon.

## **6.5 RECOMMENDATIONS FOR FUTURE RESEARCH**

This study focused on delivering a proposed e-learning framework. Based on the analysis in Chapter 5, valuable and useful negative and positive comments and suggestions were proposed by participants. The author analysed and summarised these changes from the initial proposed e-learning framework and described it below as planned changes for future work on the proposed e-learning framework. The list of changes included:

- Rerun the evaluation and conduct interviews to strengthen this research case and present the findings in a research paper presenting a revised framework.
- Conduct the evaluation among a larger sample group of participants and widen the scope of the participant's roles to focus on diverse roles, specifically managers.
- Analyse and institute recommended changes and enhancements to the proposed e-learning framework from this study to deliver a newer version of the framework.
- Further simplify and detail all parameters and stakeholders roles in the proposed e-learning framework.
- The e-learning content and assessments needs to be managed separately to that of developing and procuring an e-learning system.

This study identified that several opportunities existed through future research enhancing the development of e-learning systems. The recommendations for future research in e-learning included:

- To establish that a broader and larger sample group be considered for future research. A larger sample group assisted in providing diverse interpretations of the proposed pedagogic e-learning framework.
- To consider the role and structure of e-learning systems to develop skills, promote the culture of education and provide quality learning environments.
- To strive for greater insight into the way technology may be used to support and enhance learning and teaching environments from a pedagogy perspective and investigate the practical feasibility of the proposed e-learning framework to assess the focus on the pedagogy factors of e-learning.
- To study the learner's perspective that would also establish the extent of user acceptance of e-learning systems and may necessitate further changes to the framework from an end-user perspective.
- To study implications of the proposed e-learning framework so as to: support the architecture for integrating online courses with existing systems; incorporate curriculums for learning institutions and linking existing processes and systems in an effort to deliver up to date quality learning systems.
- Investigate the failure of e-learning systems and the lack of knowledge that results in organizations hesitating to pursue e-learning initiatives. Such a study would attempt to identify the factors affecting e-learning and thus enable the measurement of the failure or success of e-learning systems.
- Undertake a study from the learner's perspective to determine the extent of user acceptance of e-learning systems. This study may necessitate further changes to the framework from an end-user perspective. Further research will provide greater insight into the way technology will support learning and teaching environments.

- Extend and enhance the proposed e-learning framework to include the relevant institutions and e-learning stakeholders so the industry can benefit from the proposed framework.

## **6.6 CONCLUSION**

The purpose of this dissertation originated with the inconsistencies in the understanding of pedagogy principles contained within e-learning systems and the lack of a comprehensive, accepted e-learning framework. A pedagogic e-learning framework for the design and development of e-learning systems was proposed to address the main purpose of this study. The proposed pedagogic e-learning framework was based on a theoretical foundation and provided direction for incorporating pedagogical factors and identifying the importance of the role of technology at the time of inception of e-learning systems. The literature highlighted the need to focus on a framework that addressed the learner needs in e-learning systems. The findings of the research method established that the proposed framework was essential and extracted the learning requirements from the point of an identified need for e-learning systems. Based on the findings of the analysis of the survey, it may be concluded that the framework addressed the need for a structured approach to e-learning system design and development.

The author therefore proposes that the pedagogic framework for e-learning provided a valuable guide to the design and development of e-learning systems.

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## APPENDIX A

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### **Covering letter**

The covering letter below will introduce the researcher, the current study and the researcher's perspective on the study.

UNISA School of computing  
College of Science, Engineering and Technology  
Pretoria  
0003  
21 September 2012

Dear Sir / Madam,

### **Questionnaire cover letter**

I am currently registered for a Masters Degree in Science in the field of Information Systems through the University of South Africa, under the supervision of Mrs Patricia Mae Gouws. I am conducting a research study as a prerequisite for completion of the degree and request your voluntary participation in this research process.

The focus of my research is based on a proposed framework for the design of e-learning systems based on learner requirements.

The study is based on a structured questionnaire to facilitate the collection of data. The questionnaire aims to identify the effectiveness of the proposed framework and elements to primarily consider learner and learning requirements during the design of e-learning systems.

As a participant in the research process, you are kindly requested to complete the attached questionnaire and return the completed questionnaire and the signed consent form to the researcher via email ([renita.madhan@gmail.com](mailto:renita.madhan@gmail.com)).

Information provided on the questionnaire will be handled in a confidential manner and anonymity will be adhered to. A summary of the results upon completion of the

research is available upon request. Kindly email [renita.madhan@gmail.com](mailto:renita.madhan@gmail.com) for further information.

Thank you for taking the time to participate in this research study. Your input is valuable to this process.

Yours sincerely,

Renita Ramanand

## APPENDIX B

---

### Consent form

The participants will be required to complete the consent form in agreement to participate in the research study.

This research is conducted by Renita Ramanand, under the supervision of Mrs Patricia Mae Gouws on behalf of the University of South Africa.

**Purpose of research:** the purpose of the research study is to ascertain whether learner and learning requirements are incorporated into the design of e-learning systems based on the proposed framework for design.

**Estimated duration:** approximately 30 minutes to complete the questionnaire.

**Participants:** The participants of this study include all IT analysts, designers and role players in the design of e-learning systems. As a participant, your contribution to this study is voluntary and you are allowed to withdraw from the study at any point should you feel uncomfortable to continue. Your honest opinions, experiences and input provided are valuable to this study and will be treated in a confidential manner.

### Procedure for participants to follow:

- Complete and sign the consent form
- Complete the questionnaire
- Forward the completed questionnaire and consent form to Renita Ramanand

**Risks and benefits:** There are no known risks associated with this study. The framework provides essential elements in the design of e-learning systems that you may find beneficial in your current design environment.

**Compensation:** There is no financial compensation for this study.

**Confidentiality:** Information collated in this study is for statistical purposes only and will not be disclosed. Strict confidentiality will be maintained at all times.

**Consent:** The participation in this study is voluntarily. By agreeing to participate in this study, you are doing so at your own free will and can withdraw at any stage. Any queries maybe directed to the researcher by email ([renita.madhan@gmail.com](mailto:renita.madhan@gmail.com)) or the research supervisor, Mrs Patricia Mae Gouws via email ([gouwsp@unisa.ac.za](mailto:gouwsp@unisa.ac.za)).

**Acknowledgement:** I hereby agree to participate in this study and understand that the information provided will be maintained in a confidential manner. Results from this research maybe published in conference proceedings and research journals maintaining anonymity where required.

<b>Surname:</b>	<b>First name:</b>
<b>Signature:</b>	<b>Date:</b>

Thank you for taking the time to complete the questionnaire.

## APPENDIX C

### **QUESTIONNAIRE: E-LEARNING SYSTEM DESIGN**

#### **PURPOSE**

A survey is being carried out to measure the appropriateness of elements in a framework for the design of e-learning systems.

All responses are anonymous.

The survey will close on 30 November 2012. Please direct any queries to [renita.madhan@gmail.com](mailto:renita.madhan@gmail.com).

Please complete the questionnaire below by placing a cross (X) next to your most suitable response or indicating your answer in writing within the grey shaded text boxes where necessary.

#### **SECTION A: BIOGRAPHICAL INFORMATION**

**1. Indicate your gender:**

MALE

FEMALE

**2. Indicate your age in years:**

**3. The position you are employed in your organization:**

<input type="checkbox"/> Analyst	<input type="checkbox"/> Designer	<input type="checkbox"/> Developer
<input type="checkbox"/> Manager	<input type="checkbox"/> Project Manager	<input type="checkbox"/> Other, please specify:

**4. How long have you been employed at your organization?**

**SECTION B: UNDERSTANDING E-LEARNING**

**5. An e-learning system communicates learning through instruction to promote the transfer of skills**

<input type="checkbox"/> Strongly Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Undecided	<input type="checkbox"/> Disagree	<input type="checkbox"/> Strongly disagree
---	--------------------------------	------------------------------------	-----------------------------------	--

**6. A structured framework for the design of e-learning systems can significantly reduce the failure of e-learning systems**

<input type="checkbox"/> Strongly Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Undecided	<input type="checkbox"/> Disagree	<input type="checkbox"/> Strongly disagree
---	--------------------------------	------------------------------------	-----------------------------------	--

**7. A framework guides the design and development of e-learning systems**

<input type="checkbox"/> Strongly Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Undecided	<input type="checkbox"/> Disagree	<input type="checkbox"/> Strongly disagree
---	--------------------------------	------------------------------------	-----------------------------------	--

**8. Technology that incorporates learning requirements can enhance learning**

<input type="checkbox"/> Strongly Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Undecided	<input type="checkbox"/> Disagree	<input type="checkbox"/> Strongly disagree
---	--------------------------------	------------------------------------	-----------------------------------	--

**9. Technology advancements influence the learning methods and techniques in e-learning systems**

<input type="checkbox"/> Strongly Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Undecided	<input type="checkbox"/> Disagree	<input type="checkbox"/> Strongly disagree
---	--------------------------------	------------------------------------	-----------------------------------	--

***Provide comments on questions 5-9 if necessary:*** \_\_\_\_\_

**SECTION C: FRAMEWORK FOR E-LEARNING SYSTEM DESIGN**

For research purposes, a proposed framework for the design of e-learning systems is indicated in Table 1. Indicate your responses to the statements with reference to the framework below:

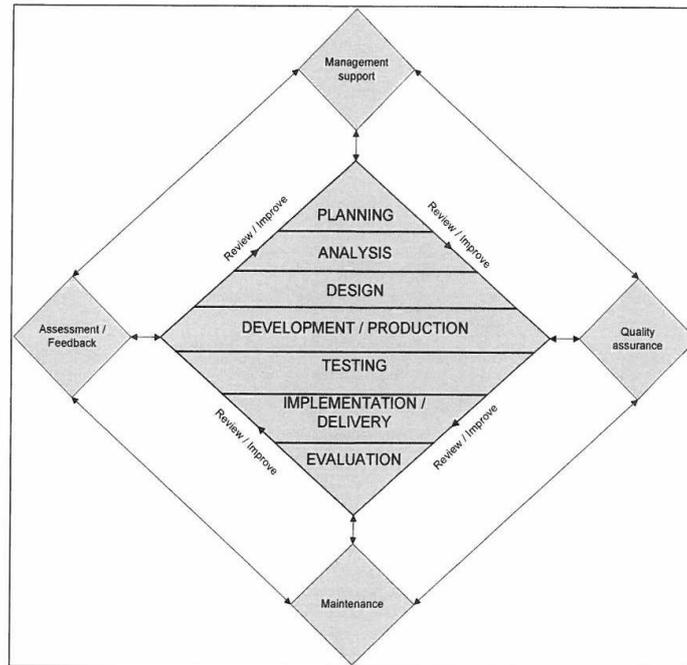


Table 1: Proposed framework for design of e-learning systems

10. The planning stage is crucial in determining the goals and objectives of an e-learning system

<input type="checkbox"/> Strongly Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Undecided	<input type="checkbox"/> Disagree	<input type="checkbox"/> Strongly disagree
---	--------------------------------	------------------------------------	-----------------------------------	--

11. Specific learner needs and principles are established in the planning stage

<input type="checkbox"/> Strongly Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Undecided	<input type="checkbox"/> Disagree	<input type="checkbox"/> Strongly disagree
---	--------------------------------	------------------------------------	-----------------------------------	--

12. The analysis stage following planning specifies all requirements for an e-learning system

<input type="checkbox"/> Strongly Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Undecided	<input type="checkbox"/> Disagree	<input type="checkbox"/> Strongly disagree
---	--------------------------------	------------------------------------	-----------------------------------	--

**13. Learning requirements omitted from the planning stage are incorporated in the analysis stage**

<input type="checkbox"/> Strongly Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Undecided	<input type="checkbox"/> Disagree	<input type="checkbox"/> Strongly disagree
---	--------------------------------	------------------------------------	-----------------------------------	--

**14. The design stage is significant to align learning needs with appropriate technology**

<input type="checkbox"/> Strongly Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Undecided	<input type="checkbox"/> Disagree	<input type="checkbox"/> Strongly disagree
---	--------------------------------	------------------------------------	-----------------------------------	--

**15. In the development stage, tutorials and learning material aid learners to improve their understanding of learning content**

<input type="checkbox"/> Strongly Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Undecided	<input type="checkbox"/> Disagree	<input type="checkbox"/> Strongly disagree
---	--------------------------------	------------------------------------	-----------------------------------	--

**16. The testing stage is imperative to test whether the systems design and content is suitable for learning**

<input type="checkbox"/> Strongly Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Undecided	<input type="checkbox"/> Disagree	<input type="checkbox"/> Strongly disagree
---	--------------------------------	------------------------------------	-----------------------------------	--

**17. During the implementation stage, stakeholders are briefed on the complete e-learning system**

<input type="checkbox"/> Strongly Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Undecided	<input type="checkbox"/> Disagree	<input type="checkbox"/> Strongly disagree
---	--------------------------------	------------------------------------	-----------------------------------	--

**18. The evaluation stage improves the overall functionality of the e-learning system**

<input type="checkbox"/> Strongly Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Undecided	<input type="checkbox"/> Disagree	<input type="checkbox"/> Strongly disagree
---	--------------------------------	------------------------------------	-----------------------------------	--

**19. Effective management is needed to monitor the continuity of the e-learning system**

<input type="checkbox"/> Strongly Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Undecided	<input type="checkbox"/> Disagree	<input type="checkbox"/> Strongly disagree
---	--------------------------------	------------------------------------	-----------------------------------	--

**20. A maintenance support function is necessary to minimize system downtime**

<input type="checkbox"/> Strongly Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Undecided	<input type="checkbox"/> Disagree	<input type="checkbox"/> Strongly disagree
---	--------------------------------	------------------------------------	-----------------------------------	--

**21. Learning assessments is essential to monitor learners progress**

<input type="checkbox"/> Strongly Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Undecided	<input type="checkbox"/> Disagree	<input type="checkbox"/> Strongly disagree
---	--------------------------------	------------------------------------	-----------------------------------	--

**22. Feedback provides continuous communication on the effectiveness of the system that may necessitate further system enhancements**

<input type="checkbox"/> Strongly Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Undecided	<input type="checkbox"/> Disagree	<input type="checkbox"/> Strongly disagree
---	--------------------------------	------------------------------------	-----------------------------------	--

**23. Quality assurance is essential to maintain credibility of an e-learning system**

<input type="checkbox"/> Strongly Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Undecided	<input type="checkbox"/> Disagree	<input type="checkbox"/> Strongly disagree
---	--------------------------------	------------------------------------	-----------------------------------	--

**24. The review and improve stage is ongoing to manage changes that need to be made to the e-learning system**

<input type="checkbox"/> Strongly Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Undecided	<input type="checkbox"/> Disagree	<input type="checkbox"/> Strongly disagree
---	--------------------------------	------------------------------------	-----------------------------------	--

**25. The proposed e-learning framework provides a suitable approach to the design of e-learning systems**

<input type="checkbox"/> Strongly Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Undecided	<input type="checkbox"/> Disagree	<input type="checkbox"/> Strongly disagree
---	--------------------------------	------------------------------------	-----------------------------------	--

**26. List any objections or comments you may with the overall framework or any part thereof**

***Thank you for completing this questionnaire***

## APPENDIX D

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Ms R Ramanand (30329248)  
School of Computing  
UNISA  
Pretoria

2012-09-20

### Permission to conduct research project

Ref: 039/RR/2012

The request for ethical approval for your MSc (Computing) research project entitled "Towards a proposed framework for an e-learning system" refers.

The College of Science, Engineering and Technology's (CSET) Research and Ethics Committee (CREC) has considered the relevant parts of the studies relating to the abovementioned research project and research methodology and is pleased to inform you that ethical clearance is granted for your study as set out in your proposal and application for ethical clearance.

Therefore, involved parties may also consider ethics approval as granted. However, the permission granted must not be misconstrued as constituting an instruction from the CSET Executive or the CSET CREC that sampled interviewees (if applicable) are compelled to take part in the research project. All interviewees retain their individual right to decide whether to participate or not.

We trust that the research will be undertaken in a manner that is respectful of the rights and integrity of those who volunteer to participate, as stipulated in the UNISA Research Ethics policy. The policy can be found at the following URL:

[http://cm.unisa.ac.za/contents/departments/res\\_policies/docs/ResearchEthicsPolicy\\_appovCounc\\_21Sept07.pdf](http://cm.unisa.ac.za/contents/departments/res_policies/docs/ResearchEthicsPolicy_appovCounc_21Sept07.pdf)

Please note that if you subsequently do a follow-up study that requires the use of a different research instrument, you will have to submit an addendum to this application, explaining the purpose of the follow-up study and attach the new instrument along with a comprehensive information document and consent form.

Yours sincerely

A handwritten signature in black ink, appearing to read "H. H. Ramanand".

Chair: School of Computing Ethics Sub-Committee



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## APPENDIX E

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### A FRAMEWORK FOR THE DESIGN OF AN E-LEARNING SYSTEM

**Renita Ramanand, School of Computing, College of Science, Engineering and Technology, University of South Africa, South Africa**  
[renita.madhan@gmail.com](mailto:renita.madhan@gmail.com)

**Patricia M Gouws, School of Computing, College of Science, Engineering and Technology, University of South Africa**  
[gouwspm@unisa.ac.za](mailto:gouwspm@unisa.ac.za)

**Keshnee Padayachee, School of Computing, College of Science, Engineering and Technology, University of South Africa**  
[padavk@unisa.ac.za](mailto:padavk@unisa.ac.za)

**Abstract:** The aim of this paper is to propose an e-learning framework to address the design and development of an e-learning system. The dimensions of the framework are aligned to pedagogical principles that are required in this design and development. The derivation of the framework involved the analysis of existing e-learning frameworks and models, and the identification of the critical dimensions and elements that are relevant to learning requirements. The proposed framework was evaluated through empirical research using a survey of organisations that develop and implement e-learning systems. The analysis and interpretation of the data is presented in this study. The future recommendations for this research are outlined as an initiative to advance the design of e-learning systems.

#### **Keywords**

E-learning, e-learning system, e-learning framework, learning, pedagogy

#### **Introduction**

This study seeks to address the problem faced by designers and developers of e-learning systems due to the changes in pedagogy and technology. These changes affect the design of e-learning systems outside of a structured, guided e-learning framework. The purpose of this paper is to explore the interpretations of e-learning definitions, to propose a definition for e-learning in the context of this study and to propose a framework for the design and development of an e-learning system. The extant e-learning frameworks are discussed leading to the derivation of the e-learning framework in this study. The stakeholders in this study refer to the learners, instructors, society and government who participate in or benefit from the provision of education.

#### **Defining e-learning**

A preliminary definition of e-learning by Sangra, *et al.*, (2012) entails an approach to both teaching and learning, representing all or part of an educational model. This model is based on the use of electronic media and devices and as tools for improving the access to training, communication and interaction that facilitates the adoption of a new way of understanding and developing learning. According to the American Society for Training and Development (2011) e-learning is defined as encompassing a wide set of applications and processes, such as web-based learning, computer-based learning, virtual classrooms, and digital collaboration. E-learning includes the delivery of learning content via the internet, intranet, extranet, networks, audio, video, satellite broadcast, interactive CD and CD-Rom. The ASTD (2011) definition considers e-learning to be anything electronic and internet-based, focusing on the learning delivery methods. Veerasamy (2010) stated that the e-learning terminology represented more than online learning, virtual learning, distributed learning, networked or web-based learning. There is an understanding that the e-learning definition incorporates all educational activities that are carried out by individuals or groups that are

working online or offline via networked or stand-alone computers and other electronic devices (Veerasingam, 2010). Varied definitions of e-learning exist as a result of the diverse understanding (Morrison, 2004; Mason & Rennie, 2006). Researchers attribute the misconception and confusion of e-learning to the lack of a formally accepted definition which would identify with the need for pedagogy principles and guide researchers to apply models and frameworks to implement and improve the provision of e-learning (Khan, 2002; Mason & Rennie, 2006; Phillips, 2004; Sangra, *et al.*, 2012). Such an investigation into the definition of e-learning entails a discussion of education, teaching, learning and ICT, where learning, pedagogy and technology, forms the basic platform (Friesen, 2009). The definition of e-learning is dynamic in that it continuously adapts to trends as a result of changes in education, curricula, technology and contributions as a result of research in the field of education and learning with the promise of structuring education within the context of technology (Sangrà *et al.*, 2012). Understanding the e-learning concept has challenges in that: there is no coherent definition (Hui, 2007); the varying interpretations contribute to the confusion about what exactly e-learning is (Mason & Rennie, 2006) and e-learning means different things to different people as determined by its context (Morrison, 2004). The varying definitions highlighted in the study show the majority of the interpretations focus on technology rather than pedagogy.

The definition for e-learning, derived by this author for this study, established that e-learning is an electronic learning process to facilitate and to maintain the acquisition of knowledge and transmission of learning content to learners through an acceptable pedagogy-technology enriched platform. The aim of the derived e-learning definition is to recognise the significance of learning, pedagogy and technology that is essential to e-learning.

### **Pedagogy principles**

Over the years, the term *pedagogy* has maintained its meaning of “leading or guiding to learn” (Beetham and Sharpe: 1, 2013). The significance of the pedagogical principles is that the pedagogical planners are required to identify the essential elements for the successful design of e-learning systems to assist the designers to form a coherent structure to the design process. Govindasamy (2002) believes that the pedagogical principles ought to form the basis of every e-learning system. These may be extended in order to accommodate for the changes in technology. Researchers offer general pedagogical principles, however the relevance of specific pedagogical principles are determined by the requirements of the learning context (Beetham& Sharpe, 2013). The key pedagogic principles of e-learning according to Anderson & McCormick (2005) contribute to the development of effective e-learning systems. These principles indicate that pedagogy should: (a) match the learning curriculum based on clear objectives, content, activities and the nature of assessments; (b) be inclusive in terms of varying achievements and disabilities that can be accommodated through e-learning, social, ethnic groups and gender; (c) engage, educate and motivate learners; (d) justify the need for learning technologies and the need for e-learning; (e) enable effective learning through the use of varying approaches of the learning platform; (f) provide for formative assessments; (g) include valid, comprehensive, reliable summative assessments excluding emotional impact to the learner; (h) be open and accessible in design and consistent in matching the objectives, content, activities and assessments; (i) ensure transparency of e-learning; (j) ensure that technology solutions are cost effective, sustainable and justified. The aim of adhering to the pedagogic principles in the design and development of e-learning systems improves the learning experiences of learners in all e-learning environments. The advantage of the pedagogic principles contribute to the development of pedagogic learning materials, resources and activities as the learner plays an active role in their learning process (Anderson & McCormick, 2005).

Pedagogy principles are key in this study, with the emphasis on role players becoming aware of what and how learners are required to learn through a technology medium. The pedagogic elements that form the building blocks for learning within an e-learning framework were considered and summarized in the literature study, namely: assessment and feedback; capacity building; content; contribution by instructors; culture; equity; interactivity process; learning principles; learning process; learning style; planning; quality assurance; user satisfaction. These pedagogic factors were consolidated into the proposed e-learning framework at various stages in each dimension.

### **Problem statement**

The existing problem is that e-learning lacks a conclusive structure to implement technology solutions in line with pedagogy principles. An effort is made in this study to examine the existing pedagogic elements in extant e-learning frameworks and to derive a pedagogic framework for the design and development of an e-learning system to ensure that the e-learning systems are aligned with pedagogical principles. The derivation of a standardised e-learning

definition is critical as the literature study identified the varying interpretations of the concept. It is proposed that a learner-centred approach should be the core focus for design interventions. The proposed e-learning framework is intended to add value to the design and development of e-learning systems with the core focus on incorporating pedagogic principles within the dimensions of the framework. In years to come, current and existing technologies and tools may become outdated, yet learning opportunities will continue to evolve based on pedagogy and technology requirements. By harmonizing the synergy between pedagogy and technology, the proposed e-learning framework can resolve the lack of adherence to pedagogic principles in e-learning system design and development. For the purpose of this research we propose the dimensions of the e-learning framework to provide structure to organisations involved in the design and development of e-learning systems. The aim is to provide a guide and structure approach to enhance the focus on a learner-centred approach.

The purpose of the empirical study is to investigate whether the proposed pedagogic e-learning framework evaluated by organisations would aid the design and development of e-learning systems. The research questions posed in this paper are:

1. What e-learning frameworks exist to develop and enhance the design of e-learning systems for learning and technology?
2. What is an appropriate framework and its contributing elements to develop and enhance the design of an e-learning system for learning and technology?

### **Extant e-learning frameworks**

Several factors contribute to the creation of a meaningful environment that accommodates diverse learning styles, learning needs and dimensions of an e-learning environment must be explored (Khan, 2005). Frameworks and components exist with an e-learning focus, which describe key elements that influence e-learning (Oliver, 2005). The literature survey undertaken identified e-learning frameworks which contributed to the development of the pedagogical framework for e-learning for this study. The extant frameworks include: the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model (Clark, 1995); a Framework for e-learning (Khan, 2001); the e-learning P3 model (Khan, 2004); the Dick and Cary instructional model (Dick, Walter, Carey, L and Carey, J.O, 2005) and the Technology Enhanced Learning (TEL) framework (Huang, de Pablos, Lytras and Gasevic, 2008). The literature was investigated to determine the various perspectives with the emphasis on pedagogic principles, structure and systematic guidance.

*The ADDIE model* stems from instructional design models (Clark, 1995), displaying a generic, systematic framework to the instructional design process, giving insight into targeting specific technology for learner requirements. The aim is to provide designers with a structured approach where processes are accurately interpreted as per system requirements. The model contains detailed measurable outcomes guiding the learning process according to detailed measurable outcomes. The ADDIE model provided a structured approach to design because the model is flexible and allows for activities and evaluations to be performed in each phase. The stages in the model include: (a) analysis; (b) design; (c) development; (d) implementation and (e) evaluation.

The *Eight dimensional framework for e-learning* created a flexible, open, effective, and distributed learning environment to cater for diverse learners using instructional design principles. Khan (2001) identified components including: (a) institutional; (b) pedagogical; (c) technological interface design; (d) design interface; (e) evaluation; (f) management; (g) resource support; and (h) ethical considerations which are listed randomly and not as steps in the framework. The components generated many questions during the planning and design phases where dimensions of e-learning impacted on the design of e-learning systems (Khan, 2001). The e-learning framework focused on learner support, adhering to a structured design process where analysis, design, evaluation, and implementation were emphasised. The challenge was in the transformation of learning curricula, policies and strategies which require stakeholders to accept the advantages e-learning has to offer. Khan maintained that this shift from traditional teaching to e-learning required a change of mindset for instructors and increased focus on the scope of learning requirements requiring a more user-friendly system. Responses, feedback and enhanced requirements were considered to be essential to improve learning, design and the effectiveness of e-learning systems (Khan, 2010).

The *e-learning P3 Model* highlighted the stages of the e-learning process stipulating the purpose and outputs of role players, planning and learning requirements (Khan, 2004). The activities placed significant importance on the need to include pedagogy throughout the model with the aim to ensure role players included pedagogical features according to the project plan and learner requirements. Through each stage in this model, learning and pedagogical elements are factored in where the adherence to learning needs was shared responsibility by all role players. The components of the model, namely: (a) planning; (b) design; (c) production; (d) evaluation; (e) delivery and (f) maintenance incorporate the pedagogy requirements throughout the model.

The *Dick & Carey Instructional Design Model* (Dick *et al.*, 2005) detailed a systematic eight step model, providing an interrelated view of instruction in identifying a dynamic relationship between context, content, learning, instruction and role players in achieving learning outcomes. The model details the eight steps, namely: (a) identify instructional goals; (b) conduct instructional analysis and identify entry behaviors; (c) write performance objectives; (d) develop criterion-referenced test items; (e) develop instructional strategy; (f) develop and select instructional materials; (g) develop and conduct formative evaluation; (h) design and (i) conduct summative evaluation. The need to synchronize these factors was evident when improper planning and coordination of e-learning systems was a large contributing factor to low satisfaction rates. The model is effective in designing instruction as a vital role to develop relevant, feasible learning systems to meet learning objectives.

*Technology Enhance Learning* offered technology solutions to meeting learning needs with the focuses on the ease of accessibility to learners irrespective of age, gender and social status (Huang *et al.*, 2008). There was a need address relevant technologies for user-centered learning. The advantage of TEL was that it was able to include any type of e-learning content or computer-based training (CBT). Although TEL focuses on technology, attention was attributed to pedagogical principles in terms of: needs analysis, outline of learning objectives, learning styles, authored learning segment, standards, and availability of courses to learners. The components of TEL included: (a) training needs analysis; (b) learning objectives; (c) learning object repository and (d) learning objectives presented to learner according to learner style. Given that the framework focuses on a technological learning solution, more focus was required on pedagogy principles and the planning stage (Huang *et al.*, 2008).

An e-learning framework provides overall guidance and support to any learning type and teaching style in any classroom or online learning environment (Kuchi, Gardner and Tipton, 2003). According to Khan (1997) and Oliver (2005) the e-learning frameworks and components exist with the focus on describing essential elements to influence e-learning outcomes with other factors in order to create a meaningful learning environment. Hence the e-learning framework in light of the explanations ought to provide for components, pedagogy principles and components to achieve positive learning outcomes in e-learning systems. The extant frameworks guided e-learning systems design in the attempt to resolve pedagogy concerns whereby each of the frameworks comprises of essential components that contributed to a pedagogy framework for the design and development of e-learning systems.

### **A proposed framework for e-learning**

The proposed e-learning framework in Figure 1 represents an overview focusing on e-learning systems development with the encapsulation of the identified dimensions. The figure highlights the foundation dimension, support dimension and the cyclic dimension with the intention of improving the learning process through a technology medium. The derivation of the proposed e-learning framework stems from research and extant frameworks and models presented in the literature study (Clark, 1995; Khan, 2001; Khan, 2004; Dick *et al.*, 2005; and Huang *et al.*, 2008). The proposed framework is aligned to the achievement of learning objectives and strategic goals as ascertained by learning requirements and an identified need for an e-learning system. The detail of the main dimensions include the following stages, namely: the foundation dimension (planning, analysis, design, testing, evaluation and implementation); support dimension (management, maintenance, assessment and feedback, quality assurance) and the cyclic dimension (review and improve stage).

#### *Foundation dimension*

The foundation dimensions comprises of the stages, namely: planning; analysis; design; development; testing; implementation and evaluation.

**Planning:** provides structure to outline and establish learning requirements, technology outcomes, goals and objectives and to guide all role players in the process with the outcome of a project plan. The pedagogical principles

outlined in the planning stage include: learners (identify learning principles; learning style; culture; equity) instructors and stakeholders involved in the process; process of learning, content and curriculum requirements).

Analysis: the outputs are analysed against the requirements ensuring that learning requirements, technology infrastructure, types of media, learning requirements, learning material, activities; risks, challenges and constraints associated with stakeholders are incorporated. The target audience, learning levels, durability of content and resources are established along with the input of management personnel and the motivational state of learners and content is determined through a needs analysis. The user requirements specification entails the derivation of the dimension through Clark (1995); Dick & Carey (2005); Huang *et al.*, (2008) & Khan (2001, 2004).

Design: pursued from the user requirements specification based on learning objectives and is the most suitable method to present learning content. A review of technology determines whether existing technology suffices to communicate e-learning content, is cost effective, reliable to operate efficiently with the least amount of disruption to learning and teaching, secure, robust and applicable to meet learning requirements. The course material is developed where designers cater for adequate contact time for learner interaction with the system. Positive learner response may enhance learner motivation alternatively a negative learning experience could be detrimental. The designer must enforce the pedagogy elements during design to encourage positive, active learning interventions.

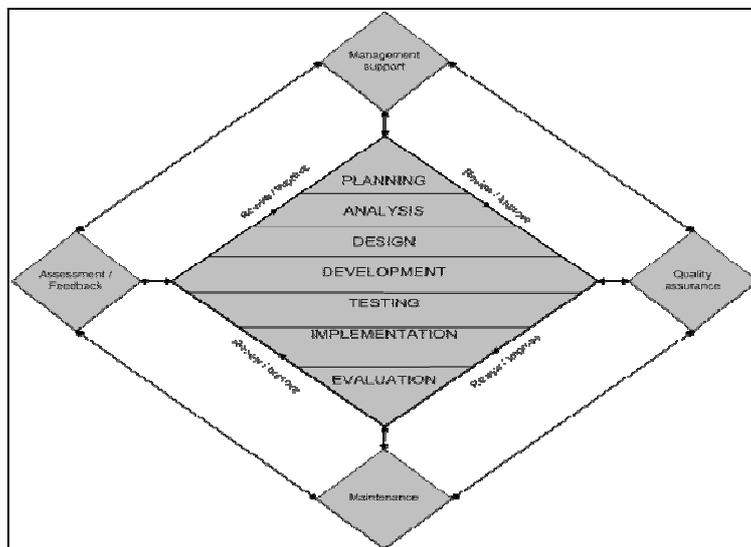


Figure 24: Proposed framework for e-learning

Development: output from design provides input for development whereby the e-learning system is created as per the project plan. The development stage benefits from the application of the phases of instruction for effective transfer of knowledge, skill and recognition of prior knowledge.

Testing: includes pilot testing where the learner’s expectations and experiences with the content, the manner in which it was presented, the interaction and general design of the system are tested. The system is piloted among a selected group of learners and instructors within a specified time period, with the purpose of providing feedback on the system through a structured process. Further testing is conducted through learners or designers, internally even after changes have been made. The system and content is tested for functionality against the technology platform chosen in the design phase.

Implementation: the most suitable method of instruction presents the e-learning system where training material and electronic content forms the output from this phase. Depending on the system development requirements, further integration with existing platforms and systems may result including routine training at this stage.

Evaluation: records and improves the functionality of the system to all stakeholders and guided by an evaluation plan to analyse the effectiveness of the e-learning system. An assessment of the learner is carried out to ascertain the relevance of design and development techniques to the quality of the learning provided, method of instruction, layout, design and relevance of content. According to the development process, the learner's feedback is analysed and subsequent changes may be referred to the development stage if necessary.

#### *Support dimension*

Management support; maintenance; assessment, feedback and quality assurance form the support dimension. Management support: is responsible for maintaining learning goals and objectives long after the system is in use and ensuring continuity through the management team established at the start of the process. The stage supports all learners, learning environment and strategically aims to resolve stakeholder's queries and levels of training interventions required. Support ensures learners maintain active learning and impeding factors are minimized.

Maintenance: ensures continuous system readiness, minimal downtime, controls further infrastructure requirements. Security measures are instituted and managed and learning content is maintained to include updates on curriculums and further distribution of e-learning material.

Assessment and feedback: identifies with the learners experience and determines and rectifies low performance in learning areas. Assessments provide evidence, understanding of levels of learners. Instructors assess technology effectiveness to determine existing and future learner's instruction needs through an assessment tool. Satisfactorily assessing learners through an automated or online process encourages learners to become aware and take responsibility for their individual learning. Feedback and assessment is conducted on learners, instructors and the e-learning system. Feedback is monitored and recorded so as to identify trends among problems experienced.

Quality assurance: ensures standards are maintained according to policy, curriculum requirements and strategic objectives. A structured and standardized approach in line with recognised qualification frameworks is highlighted in the planning phase. Benchmarking, quality metrics and e-learning quality frameworks are proposed methods to monitor and maintain quality assurance.

#### *Cyclic dimension*

The review and improve dimension is triggered where a change is necessitated and where revision is proposed through any dimension in the system. Based on the complexity of the change, the request is addressed through the planning stage in order to maintain structure in requesting changes to the system.

In the next section, the framework is evaluated using a survey of companies involved in the design and development of e-learning systems. The response rate to the survey was relatively low hence the statistics are limited in some case.

### **Research Methodology**

The empirical research used a survey research design which is quantitative in nature and conducted through a survey using a self-administered, emailed questionnaire to evaluate the use of the dimensions in the proposed framework. The survey was chosen as the preferred research method for its relatively quick response time in data collection and ability to reach the identified sample group over various geographical locations. The group comprised of local and international companies that focus on e-learning system design, including analysts; designers; developers; project managers and executive managers. The analysis of the data uses non-probabilistic purposive sampling and due to the limited response rate, the results from this study can thus not be generalized to the respective population, however was significant to achieving the objectives of the research. The respondents showed relative interest in the research of the chosen study. The characteristics employed in this study exemplified components of the quantitative methodology according to Leedy & Ormrod (2013), to: confirm and validate the responses toward the proposed framework from the survey; utilize a standardized measuring instrument such as the questionnaire; statistically analyse the numerical data using the Likert scale and to communicate the research findings through statistical analysis. The objectivity of participant responses was essential through the various roles assumed by participants in the design of e-learning systems.

## Results of data analysis and interpretation

The proposed framework was evaluated according to the ratings recorded by participants in the survey to determine that the framework would be a satisfactory method for the design and development of an e-learning system. The sample consisted of a response rate of 35%. The results of the analysis of the data collected for each of the dimensions are represented in Figure 2 for the foundation dimension, Figure 3 for the support dimension and Figure 4 representing the cyclic dimension.

### Foundation dimension

The dimensions in the foundation stage follow an iterative process where design and development follows the steps outlined. In Figure 2 the data in the planning stage showed that a combined 100% of participants ‘‘Strongly agreed’’ and ‘Agreed’’ on the importance of the planning stage as an initial stage in the framework to solicit the learner requirements at the onset of the process. In the analysis stage, a combined 72% agreed that the stage needs to specify all requirements for an e-learning system with 14% remaining undecided and 14% in disagreement with the statement. The variations in the analysis stage indicated that 43% agreed that learning requirements are to be included, while 29% remained undecided and 29% disagreed. In the design stage, 86% agreed for the need to align learning needs with technology where 14% disagreed. The development stage showed 58% in agreement, 14% undecided and twenty nine (29%) ‘Strongly disagree’. The results of the ratings for the testing stage showed 57% in agreement and 43% disagree with the statement. The results in the implementation stage indicated that 57% agreed, 14% strongly disagreed and 29% were undecided with the statement. A combined total of 57% indicated that participants agreed that the evaluation stage improves functionality whereas 43% were ‘undecided’.

The insight to the collection of data for the foundation phase showed that the majority of responses were favourable in the intention of maintaining the learner centred approach from the first to the last stage in the foundation dimension. The low rating of 43% for the fourth element in Figure 2 was as a result of the requirement to include any requirements in the analysis phase if previously omitted in the planning stage, but respondents felt this was not necessary. Responses were positive toward the foundation dimension and the need to incorporate learning and pedagogic principles right at the start. Overall, participants were in favor of the foundation dimension providing further insight on improving the dimension.

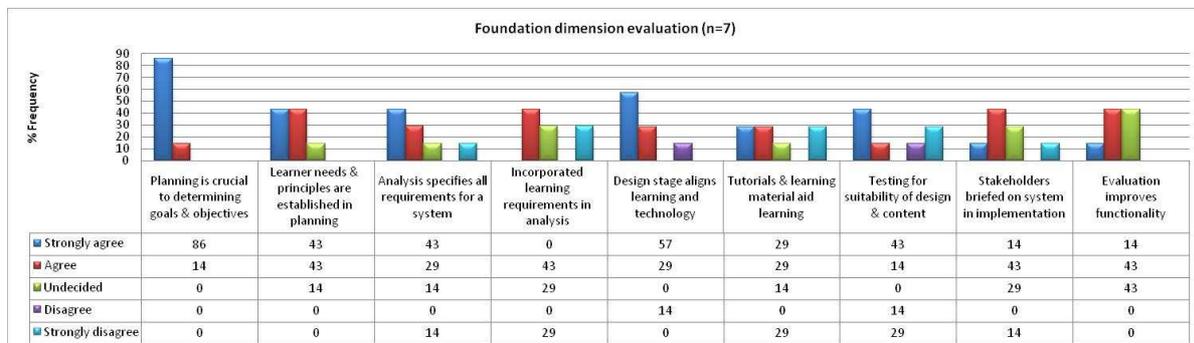


Figure 25: Foundation dimension evaluation

### Support dimension

The support dimension is accessible and conducted through any stage of the framework, allowing for amendments or updates where necessary. The support dimension also ensures the process of design and development is not conducted in isolation and independent of stakeholder input, quality assurance and support and overall maintenance and may be initiated prior to the overall completion of the e-learning system. In Figure 3 the combined percentages showed consensus that: monitoring by management; the maintenance stage and assessment were essential for continuous running of an e-learning system. Although 100% noted that feedback made the system more effective, only 91% of the respondents agreed that the quality assurance stage maintains the continuity of the e-learning system and through the framework ensures that the process is managed in a structured manner. This dimension showed positive ratings particularly where the aim was to ensure continuity and longevity of the proposed framework through a structured, managed approach.

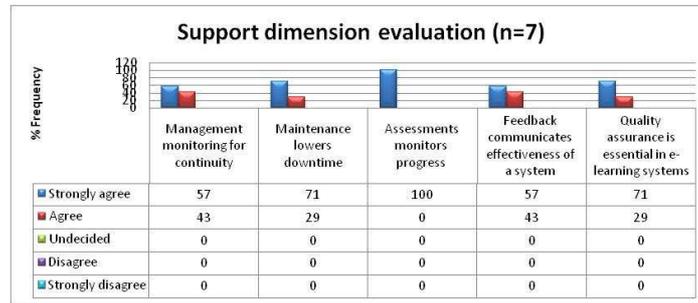


Figure 26: Support dimension evaluation

### Cyclic dimension

The cyclic dimension is to ensure that from a design perspective that any changes in learning requirements, curriculums and changes in learning due to policies can be identified and is conducted in a structured manner and follows the foundation dimension again where the outcome and requirements are identified. The support and cyclic stage are performed on an ongoing basis and taps into the foundation dimension when required. In Figure 4, a combined response shows all participants agreed that the review and improve dimension was essential to maintain the credibility of the proposed e-learning system. As a relatively repetitive step in this dimension the aim was to ensure that changes in any aspect of learning, technology or the learning curriculum can be managed through a structured process where the planning stage would trigger, but still sustain the support dimension in the event of new or existing requirements.

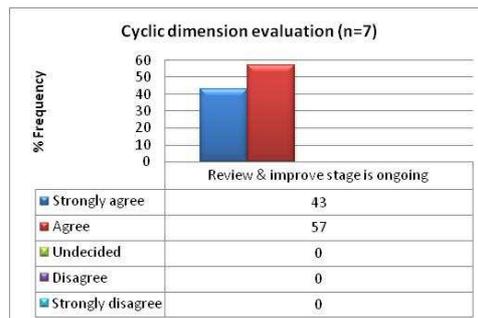


Figure 27: Cyclic dimension evaluation

The proposed e-learning framework was rated by 85% of participants as usable for the purpose of e-learning systems design and development, whereas 14% disagreed. The participant's comments suggested that minimal improvements be instituted on the framework.

The participants commented that the proposed framework be simplified further to detail parameters and provide specific detail into the each stages within the dimension. The further discussion on the analysis phase showed the specific learning needs ought to be determined primarily in the analysis phase and the requirements for a system to meet the learning needs be detailed in the design phase. Some participants identified the importance for an e-learning system to manage e-learning content and assessments independently to the process of developing and procuring an e-learning system and incorporating all learning needs in the planning stage. The recommendation that the e-learning content and assessments be handled out of the system requires further analysis and research. Although the participant's comments stressed on separating content and assessment to development, the proposed framework aimed to incorporate the learning material content into the system during development with the provision of keeping the content updated. The aim of the framework is also to maintain continuity of the system and to present updated learning material that is relevant to educational requirements. The comments also indicated that the learning content be confirmed in the planning phase while the testing stage assesses the functionality of the system. Participants stressed on the importance of the e-learning system to be user friendly and to further engage all parties concerned from the point of inception of the system, highlighting that the failure of systems often results from delayed stakeholder involvement. The comments and suggestions were noted and intended to be included in future research.

### **Implications for Practice**

The framework does not accommodate the design of a system in the absence of an identified learning need. This eliminates the premise of designing and developing a system first and then structuring the system to suit the learning content, where the learner-centred approach should be the core focus for design interventions. The framework takes into consideration the importance of captivating the learner's attention and interest to keep them motivated and ensure a seamless learning environment. A structured approach of the framework ensures and guides the process to enforce the learning objectives. Specific principles defined in the literature are populated in the dimensions in the framework. The extant frameworks discussed above indicate pedagogy as a component in the framework but eliminated the detailed discussion on how pedagogy principles are included in the frameworks. Essentially, a detailed input and output plan may be provided to present the specific requirements for each stage of the proposed framework including the detailed roles of stakeholders. The advantage would therefore be derived by preventing overlapping of the functions of each stage in the proposed framework. Therefore, the learning requirements is clearly defined and incorporated thoroughly so there is no extension of the scope of the system in the event of changing or adding learning requirements at a later stage.

With technology as the driving force, e-learning solutions were pedagogically poor, unmanageable and expensive (Jochems *et al.*, 2004). Capital injection into technology developments, to enhance the delivery of e-learning systems was substantial, but the benefits were minimal and e-learning projects continued to fail (Penna & Stara, 2007). There is an understanding that the evolution of technology in e-learning environments dictated the e-learning content and process rather than incorporating pedagogic principles and determining the actual learning requirements for learners (Beetham & Sharpe, 2013). According to Beetham & Sharpe (2013) the advancements in technology happen at a faster rate than the alignment of pedagogy to technology and e-learning systems run the risk of being pedagogically ineffective.

### **Future research**

The practical implications of the proposed e-learning framework ought to be considered so as to: support the architecture for integrating online courses with existing systems; incorporate curriculums for learning institutions and linking existing processes and systems in an effort to deliver up to date quality learning systems. A study into the learner's perspective would also establish the extent of user acceptance of e-learning systems and may necessitate further changes to the framework from an end-user perspective detailing the summarised pedagogy principles. Further research will provide greater insight into the way technology may be used to support and enhance learning and teaching environments from a pedagogy perspective.

### **Conclusion**

A framework for the design of e-learning systems was proposed to address the lack of a universally accepted e-learning design framework. Based on a theoretical foundation, the proposed framework provides direction to incorporate three dimensions to focus on the design and development of e-learning systems.

The research highlighted the need to focus on a framework that would address the learning requirements at the onset of the planning stage. The findings of the research method established that the proposed framework is essential to draw out the learning requirements from the point of an identified need for an e-learning system. Based on the findings of the analysis of the survey, it may be concluded that the framework addresses the need for a structured approach to e-learning system design and provides a valuable guide to the design of e-learning systems.

Certain limitations restricted the research findings particularly where the research was conducted only amongst role players understood to be involved in the development of e-learning systems. The sample of 20 participants was limited as a result of a search on existing local and international service providers of e-learning systems. The proposed framework was presented to participants during the survey with limited detail to substantiate the content in each stage in the framework. This was a limitation as participants had a narrow view of the logic and reasoning behind the stages included in the proposed framework and in particular the specific detail of the pedagogic principles and requested further detail into the stages of the proposed framework. Overall, the participants provided positive feedback to the proposed framework, however certain suggested improvements were recommended.

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