A Taxonomy of eLearning Frameworks

by

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DECLARATION

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I declare that the work **Taxonomy of eLearning frameworks** 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.

11/10/2021

SIGNATURE DATE

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ABSTRACT

Research in the age of the knowledge economy has revealed that there is a growing demand for human skills to fit changes necessitated by breakthrough technology (Information and Communication Technology) innovation in higher education. Subsequently, the application of eLearning has become an inevitable reality and an opportunity for software vendors to make appropriate eLearning solutions available to the learning community. However, this has resulted in a plethora of eLearning frameworks which makes it challenging for learning institutions to select and adopt an appropriate eLearning framework to support their innovation goal.

The purpose of this study is, therefore, to develop a consolidated view of existing eLearning frameworks using a taxonomy tree to guide institutions in their selection of an appropriate eLearning framework. This prime objective is achieved through the realisation of specific objectives; namely, the development of a generic eLearning framework and a methodology for eLearning adoption. The design science research methodology is applied to address the research questions identified in this study.

Preliminary research investigations lead to the identification of distinguishing characteristics of existing eLearning frameworks from which relevant building blocks are deduced. These building blocks are constructs of the generic eLearning framework proposed in this research. The components and elements of the building block are then further identified as well as the metrics for their measurement.

Another research investigation leads to the proposal of a methodology for eLearning adoption that shows a step-by-step guideline. This guideline is developed based on the generic eLearning framework and other findings from the literature. The taxonomy for eLearning frameworks is hereby constructed as a taxonomy tree with the building blocks of the generic eLearning framework as branches of the tree, as well as the classification and relationships of existing and new eLearning frameworks. The taxonomy tree provides an integrated view of eLearning frameworks (existing and derived) for ease of identification and reference by interested users. It also facilitates the selection of an appropriate eLearning framework for learning institutions. The validation and improvement exercise on the generic eLearning framework and a methodology for eLearning adoption are derived from surveys and interviews with selected participants.

This research demonstrates that the overabundance of eLearning frameworks makes their selection and adoption extremely challenging to learning institutions because of the lack of a rigorous adoption and selection approach. This is thus overcome using the developed taxonomy tree that further serves as a

guide to determine the maturity level of a learning institution followed by appropriate recommendations for improvements based on its positioning in the tree.

KEYWORDS: Education systems; eLearning; eLearning frameworks; eLearning models; eLearning building blocks; eLearning components; eLearning classification; eLearning taxonomy; eLearning adoption; eLearning maturity

DEDICATION

This thesis is dedicated to my sons (Hamdan and Mohammed), my husband and my mom. They all sacrificed the love and care they deserve for my success. I love you to the moon and back.

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LIST OF ACRONYMS AND ABBREVIATIONS

Abbreviations	Descriptions
AASTU	Addis Ababa Science and Technology University
ASTU	Adama Science and Technology University
AMOS	Analysis of Moment Structures
AMU	Arba Minch University
AVE	Average variance extracted
BDU	Bahir Dar University
CFI	Comparative fit index
CFM	Confirmatory factor model
CBT	Computer based training
DSRM	Design science research paradigm/methodology
ECSU	Ethiopian civil service University
GeF	Generic eLearning framework
HCI	Human Computer Interaction
IBT	Internet based training
ICT	Information Communication Technology
IFI	Incremental Fit Index
JU	Jimma university
KOICA	Korean international cooperation Agency
LMS	Learning Management System

MIS	Management Information Systems
MOE	Ministry of Education
MU	Mekelle University
NFI	Normed Fit Index
RMSEA	Root mean square error of approximation
SDGs	Sustainable development goals
SPSS	Statistical Package for the Social Sciences
TLI	Tucker–Lewis index
TVET	Technical and vocational education and training
VSAT	Very small aperture terminal
WBT	The Web based training

LIST OF PUBLICATIONS

1. Z. A. ABEGAZ and E. K. NGASSAM. (2015). “Preliminary classification of eLearning models.” 2015 IST-Africa Week Conference (IST-Africa), Lilongwe, Malawi. ISBN: 978-1-905824-50-2.
2. Z. A. ABEGAZ and E. K. NGASSAM, (2019) "A Generic Framework for eLearning Adoption," *2019 IST-Africa Week Conference (IST-Africa)*, Nairobi, Kenya, 2019, pp. 1-9, Doi: 10.23919/ISTAFRICA.2019.8764857

1 CHAPTER ONE: INTRODUCTION

1.1 Introduction

Advancements in the framework of ICT from both infrastructure and technology perspectives are seen as major contributing factors towards bridging the digital divide. As a result, the way of transferring knowledge is increasingly shifting towards digital knowledge transfer as opposed to the traditional face-to-face model (Georgieva E., Smrikarov and Georgiev T., 2005). The search for new approaches to learning and teaching has generated a remote method of education termed 'distance education' which has introduced the concept eLearning (Półjanowicz *et al.*, 2011). At first, distance education transformed into eLearning and then into mobile-learning (m-learning). More recently, the introduction of electronic learning (once under the umbrella of distance learning and mobile learning) has broadened the scope of eLearning (Behera cited in Gazi, 2013). eLearning is now defined as a teaching/learning process facilitated or supported by information communication technology that covers activities ranging from the use of technology in support of the traditional learning process to learning that is delivered entirely online.

With the advent of the internet, eLearning has become crucial and is gaining popularity with both industry and academia within the education cluster. In this knowledge era, the notion of learning 'anywhere anytime' is of significant importance in the sense that knowledge is expected to reach the formerly unreachable. Besides, continuous development of multimedia techniques, data exchange systems, and the so -called 'intelligent teachers', many free eLearning platforms make an important contribution to the increased interest of students in distance learning (d-learning) as well as eLearning.

An education system provides answers to the question how activities in education are done (Adeyinka, 1980). It embraces both the academic and also the administrative systems to ensure the smooth-running of the whole school system. eLearning models and frameworks can now be among the components of an educational system that works towards the achievement of the educational goal. However, the many eLearning models/frameworks in the literature suggest that education systems vary due to factors like context (Lin, 2008) and the excess of education systems worldwide (Kember, 2007 & Saxena, 2013). However, Al-Shalabi *et al.*, (2012) noted that the increasingly popularity of the development of different systems in many institutions relies on people using

their personal experience and skills to design and implement eLearning systems rather than by using a scientific understanding of their characteristics and relationships. This factor can be seen as an inhibiting aspect in the selection and adoption of an eLearning framework.

The aim of this research is, therefore, to explore existing eLearning frameworks, characterise them and then develop generic eLearning framework and a methodology for eLearning adoption. Furthermore, it seeks to provide a taxonomy of eLearning frameworks/models based on their predefined characteristics and relationships. The proposed classification will serve as a basis for the identification of appropriate eLearning frameworks and models for higher learning institutions. A survey-based case study on Ethiopian higher Learning Institutions as well as eLearning experts will be used for the verification and validation of the theoretical findings. Furthermore, a survey-based case study will also be used to assess the current status of eLearning in some selected Ethiopian higher learning institutions and demonstrate the selection of an eLearning framework from the taxonomy tree.

As part of this introduction, the next section (section 1.2) discusses the background and motivation of the study. The problem statement is presented in section 1.3. The objective of the research and the research question are explored in sections 1.4 and 1.5 respectively. In section 1.6, the research methodology and design are discussed followed by contribution of the study that is presented in section 1.7. The scope and limitation of the study as well as definition of terms are discussed in sections 1.8 and 1.9 respectively. In sections 1.10 and 1.11 ethical considerations and the chapter outline of the thesis are presented respectively. Finally, the conclusion of this chapter is provided in section 1.12.

1.2 Background and Motivation of this Study

Education is a goal in itself and the key to attain the sustainable development goals (SDGs) of most nations. It is also considered a catalytic agent to end poverty, to reduce the level of hunger to zero, to achieve gender equality, to achieve good health and wellbeing of the society, as well as to achieve a culture of peace and economic growth (García-González, Jiménez-Fontana and Azcárate, 2020; Rieckmann, Mindt and Gardiner, 2017; Dlouhá *et al.*, 2019; McInnes, 2018). Education is also considered very crucial since every other sector in the nation is inherently dependent on it. However, although individuals can get the knowledge, skills and attitudes relevant to achieve their country's SDGs through education, it is arguable that all kinds of education can

transform personal competencies into sustainability. Rather, it is the holistic learning process that addresses the cognitive, socio-emotional, and behavioural domains of learning which can bring the real change (Dlouhá *et al.*, 2019). This all-inclusive factor in the advent of knowledge economy has induced many governments to prioritise educational quality, lifelong learning and the provision of education for all their citizens. Nonetheless, it is still a challenge for education to reach every citizen, especially in developing countries.

In line with this aspect, it is also suggested that inequality in access to education remains a challenge (Haddad, 2007). The traditional (historical) mode of delivery currently prevails in most of the world's educational systems while the use of other technological means continues to be *ad hoc* and negligible (Haddad, 2007) despite the challenges by the so-called globalised economy, globalised knowledge, privatization of the education sector, financial resources and new technological, social and political requirements of education (Haddad 2007). The resolution of these challenges requires investment in further educational management and technology.

Therefore, attention ought to be given to the resolution of these current challenges through the modes of delivery to the education system. A delivery mechanism (or mode) is a way of transmitting course content to students. This currently comprises (i) distance education, (ii) traditional face-to-face instruction, and (iii) a hybrid approach which contains elements of the first two modes and discussed as follows:

- In the traditional approach, both the instructor and students are expected to present physically and communicate in a face-to-face manner. The delivery is conducted within regularly scheduled class sessions (on or off-campus).
- In distance education, there are no regularly scheduled face-to-face meetings among participants (students and instructor) though now a days, modern conferencing allows meetings being in distance. Different media can also be used to deliver course materials.
- The hybrid or composite delivery is also a mechanism that takes some of the good features of distance and traditional education and mixes them, whereby classes are offered as part of the course delivery with some distance education components and other lessons require regular face-to-face contact between students and instructor (Neichter, 2003; Aluko, 2008).

More recently, the rapid growth and advancement of ICT has contributed to the emergence of new modes of delivery that enable learners to learn anywhere and anytime at minimum cost.

Consequently, distance education has taken first place in the evolution of the education systems development, with eLearning second, followed by m-learning. Although traditional face-to-face education has the advantage of direct contact and immediate feedback, it is hampered by the fact that it is unable to help students who cannot be present at a lesson physically. Hence, the rise of distance education particularly eLearning and m-learning and many others like this, which have come into existence to fill such a gap.

The recent electronic learning mode − a subset of the distance-based mode of delivery − is the focus of this research. It is rapidly becoming the preferred mode since it is a fast way of accessing knowledge regardless of time and place constraints (Gazi, 2013) since eLearning delivers a teaching-learning process that has its own procedure by making use of any form of electronic media to facilitate knowledge exchange. Both the networked system and simple computer application are specific medias to implement this new learning process (Nagarajan & Wiselin, 2010). It is, therefore, also described as a 4th Generation distance mode of education that is the successor of correspondence, multimedia and telematic teaching (Gyambrah, 2007). Gyambrah (2007,p. 28) also defines eLearning as "a virtual campus, virtual teaching, and a flexible learning model". In other words, a teaching-learning process that enables learners and teachers to interact online without the need to correspond in time or space (Rickards, 2000). It also involves the application of two-way, interactive communication through different electronic media (Gyambrah, 2007). In addition, it has the added advantage of reaching a large number of participants anytime and anywhere and, in some circumstances, requiring minimal resources.

The interrelated components that contribute towards the achievement of an educational goal in any education system are recognisably fivefold: the teachers, students, content, context and strategy. eLearning frameworks and models advance these components. The numerous educational systems worldwide are mostly context dependent, so there should be a number of associated supporting strategies and methods such as eLearning models and frameworks.

According to the report by Kember, (2007), there are as many educational systems as there are eLearning frameworks and models in the literature (such as synchronous and asynchronous, to name a few). While eLearning frameworks and models are simply various methods or ways of implementing e-learning. However, it is cause for concern that there is no scientific mechanism to establish the relationship among these excess frameworks and models. This may be the factor that

inhibits the adoption of eLearning based on existing models in the sense that concerned potential users may feel the need to develop a new method from scratch.

Many new eLearning platforms have been developed in the past few years (Tomczyk et al., 2020) and each new teaching tool presents its own learning model. It has now become a task of ever-increasing importance to compare different eLearning platforms and to choose the most adequate one. Hence, this research is an attempt to overcome such challenges.

1.3 Research problem statement

In the knowledge era, human resource development and competitiveness will be solely dependent on access to knowledge at the local, national, regional, and global levels (Gyambrah, 2007).Education is a means of accessing knowledge and it can be delivered in different modes such as face-to-face, distance base, or a combination of both (Neichter 2003).

The Face-to-face mode of delivery has the limitation of not reaching out to a broad range of learners due to cost, time, space and location. The distance-based approach may curb the foregoing limitations although it may also be hampered by some technological limitations to be investigated (Neichter, 2003 &Georgieva, Smrikarov and Georgiev, 2005).eLearning is regarded as an electronic approach for rendering distance-based education. Through ICT, eLearning can be used to reach out to an important number of learners anywhere and anytime in a cost-effective manner. This opens up an opportunity for its global adoption by various learning institutions. The existence of various educational systems and models that are countries' and/or institutions' specific suggest that there is a plethora of eLearning frameworks and models in reality and also recorded in literature (Lin, 2008). Therefore, the adoption of an existing eLearning solution by any given institution/country should be driven by sound scientifically proven arguments that are aligned with their needs and that of their stakeholders. This suggests the need to explore the literature on eLearning frameworks and models so as to formally organize them in a taxonomy tree as per their characteristics and relationships(Naturwissenschaften and Beyene, 2010).

The outcome of such research is to give the opportunity to prospective eLearning implementers to make use of our proposed taxonomy for the identification of the appropriate frameworks that can meet the requirements of their institution as well as that of stakeholders involved.

1.4 Objectives of the Study

The main objective of this research is to **build a taxonomy of eLearning frameworks**. The developed taxonomy will form the basis for the selection of appropriate eLearning frameworks for any given learning institution. The selection is premised by a rigorous maturity assessment of the institution's eLearning adoption and practise, paving the way towards a model that improves the institution's development.

The following sub-research objectives are therefore derived from the above main objective:

- Sub-Research Objective 1 (SRO1): Investigate education systems and their alignment to eLearning.
- Sub-Research Objective 2 (SRO2*):* Explore and study eLearning frameworks and models.
- Sub-Research Objective 3 (SRO3): Develop a generic eLearning framework (GeF) and a methodology for eLearning framework adoption.
- Sub-Research Objective 4 (SRO4): Build a taxonomy of eLearning frameworks.
- Sub-Research Objective 5 (SRO5): Perform evaluation and validation.

1.5 Research Questions

The main research question is:

How can a taxonomy of eLearning frameworks be developed to enable learning institutions to easily identify an appropriate framework for their institution?

To answer this question, the following specific sub-questions will also be addressed.

- Sub-Research Question 1 (SRQ1): What are existing education systems and how are they aligned to eLearning?
- Sub-Research Question 2 (SRQ2): What are existing eLearning frameworks and models in the literature and their characteristics?
- Sub-Research Question 3 (SRQ3): How are a generic eLearning framework and a methodology for eLearning adoption developed?
- Sub-Research Question 4 (SRQ4): How is a taxonomy of eLearning frameworks developed?
- Sub-Research Question 5 (SRQ5): How are our proposed generic framework, methodology and taxonomy evaluated and validated in a real-life context of Ethiopian learning institution?

1.6 Research Methodology

It is a science of studying how research is done systematically. Different procedures commonly taken by a researcher to solve a research problem are incorporated into the research methodology. This comprises the rationale for research methods as well as why certain approaches and techniques are chosen (Kothari, 2004). In the sub-section that follows, the theoretical foundation of the research is discussed that provides the rationale behind the choice made.

1.6.1 Theoretical Foundation

Firstly, this research results in the formation of a range of artifacts such as: (i) a generic eLearning framework, (ii) a methodology for eLearning adoption, and (iii) a constructed taxonomy tree. Secondly, an evaluation follows of whether the framework, the methodology for eLearning adoption (and taxonomy thereof) significantly contributes to effective eLearning practice or not. This will be explored through a survey-based case study method. Based on the above explanation as well as the findings from the literature, the most appropriate theoretical foundation for this research is grounded on design science.

The design science research methodology (DSRM) is intended to discuss new knowledge about artificial objects that achieve specific goals and create convenience for their users (Simon 1969 cited in Nickerson *et al.*, 2009). The design science research consists of four main research outputs: constructs, models, methodologies, and instantiations, as well as two processes that include artifact construction and artifact evaluation (March & Smith 1995 cited in Nickerson *et al.*, 2009). In general, a body of work must create and test a novel artifact to be considered 'design science' (Hevner et al. 2004 cited in Nickerson *et al.*, 2009). This also has to be balanced by a need for information science research by building on existing research where possible (Kuechler & Vaishnavi 2008 cited in Nickerson *et al.*, 2009). The artifact in design science is not expected to be only a particular system or technique but can be something more abstract like a framework. The DSRM can employ data collection techniques from qualitative and quantitative methods as described in detail below:

- **Identification and motivation of a problem**: Define the research problem and explain why a solution is valuable.
- **Define the goal of the solution:** What is the best way to solve the problem? In addition to the usual objectives such as feasibility and performance, what are the specific criteria that a solution for the problem should meet?

- **Design and development**: This step provides a problem-solving artifact, such as constructs, models, methods, or instantiations that includes a research contribution.
- **Demonstration:** This step demonstrates the use of the artifact. It provides proof that the artifact works by solving one or more instances of the problem.
- **Evaluation:** How effective is the artifact? Compare the objectives to the observed findings to see how well the artifact supports a solution to the problem.
- **Communication:** This step informs researchers and other important audiences about the problem, its solution, and the utility, uniqueness, and efficacy of the solution.

Thus, since this research is based on design science paradigm, its first steps will be artifact building by:

- developing a generic eLearning framework;
- providing a methodology for eLearning adoption; and
- building a taxonomy of eLearning frameworks.

The building blocks of the generic eLearning framework are to be used as nodes in the taxonomy tree.

The next step will be the appropriateness of the generic framework whereby a methodology for eLearning adoption as well as taxonomy tree will be evaluated in the context of the Ethiopian higher learning institutions through the opinion of experts, instructors and students. The detailed activities of the research process and their description based on the standardised framework of design science research methodology as proposed by Peffers, Tuunanen and Rothenberger, (2008). These are summarised in Table 1-1below.

Table 1-1: Steps of design science research methodology and its application in this research

DSRM activities	**Activity description**
Problem identification and motivation	Despite the many options for eLearning frameworks and models in the literature, the adoption of these eLearning frameworks by any given institution/country should be driven by sound scientifically proven arguments that are aligned to their needs and that of their stakeholders.
Define the objective of a solution	To facilitate selection of appropriate eLearning framework for learning institutions the eLearning models and frameworks found in the literature will be explored. This will assist in the development of the generic eLearning framework and a methodology for specific eLearning adoption. Then, the generic framework will be a base to provide sound scientifically classified eLearning frameworks and models by using taxonomy tree.
Design and development	To build a generic eLearning framework based on the existing eLearning frameworks for the design of a methodology for eLearning adoption. Based on the generic eLearning framework, a taxonomy tree is also constructed by using building blocks of the generic eLearning framework as nodes of the tree.
Demonstration	To demonstrate the use of generic eLearning framework a methodology for eLearning adoption and taxonomy tree for an evaluation of the current eLearning practices in Ethiopian higher learning institutions. Then to select a framework that is appropriate for the requirement of a particular higher learning institutes in Ethiopia. This is done by following the steps below. o Assessing the current practice of eLearning in Ethiopian learning institutions by administering questioner, interview, observation and document analysis. o Analysing the questioners and interview and then identify the weakness and strengthen of existing education system or eLearning system/framework in line with the generic eLearning framework. o Recommending that institutions select a framework from the taxonomy tree that can best fit their requirements/current system.
Evaluation	To evaluate how well the generic eLearning framework, a methodology for eLearning adoption as well as a taxonomy tree are working for the implementation of eLearning.
Communication	To publish the outputs of the research such as generic eLearning framework and taxonomy tree in a journal of information systems.

1.6.2 Research design

A research design plan comprises stages for responding to research questions as well as a full presentation of data collection and analysis (Gay & Airasian 2003 cited in Aluko, 2008; Saunders et al., 2012 cited in Hagos, 2019). Similarly, for Yin (2003, cited in Hagos, 2019) a research design, is "a logical method for getting from here to there, in which "here" may be regarded as the initial set of research questions to be answered, and "there" being some collection of conclusions (solutions) regarding these questions".

The table revisits each of the answers to specific research questions which will collectively contribute to the main objective of the research. In so doing, concepts are explored for discussion and perceived methods to be used to answer each question are also presented.

Table 1-2: Lists of research questions with the corresponding research methods

Research Questions	**Concepts to be discussed**	**Methods to be used**
Sub-Research Question 1 (SRQ1): What are existing education systems and how are they aligned to eLearning?	● Education, education systems and eLearning ● Education theories, education system and eLearning in the world	Literature review
Sub-Research Question 2 (SRQ2): What are existing eLearning frameworks and models in the literature and their characteristics?	● eLearning Frameworks and Models ● Characteristics of eLearning Frameworks and Models	Literature review, analysis of each frameworks/model is needed
Sub-Research Question 3 (SRQ3): How are a generic eLearning framework and a methodology for eLearning adoption developed?	● Common characteristics of existing eLearning frameworks ● Generic eLearning framework ● steps for eLearning adoption	Identification, Analysis, Design and Modelling
Sub-Research Question 4 (SRQ4): How is a taxonomy of eLearning frameworks developed?	● Building blocks(classes) ● Taxonomy tree	Analysis, Design and modelling

Sub-Research Question 5 (SRQ5): How are our proposed generic framework, methodology and taxonomy evaluated and validated in a real-life context of Ethiopian learning institution?	• Framework's evaluation criteria • Framework validation techniques • Statistical tool for validation.	Survey-based case study Expert evaluation

This section also includes a diagram of the design process depending on the objectives and the methodology used. The design necessitates the use of survey-based case studies and experts' opinion. Figure 1-1 below will summarise the details

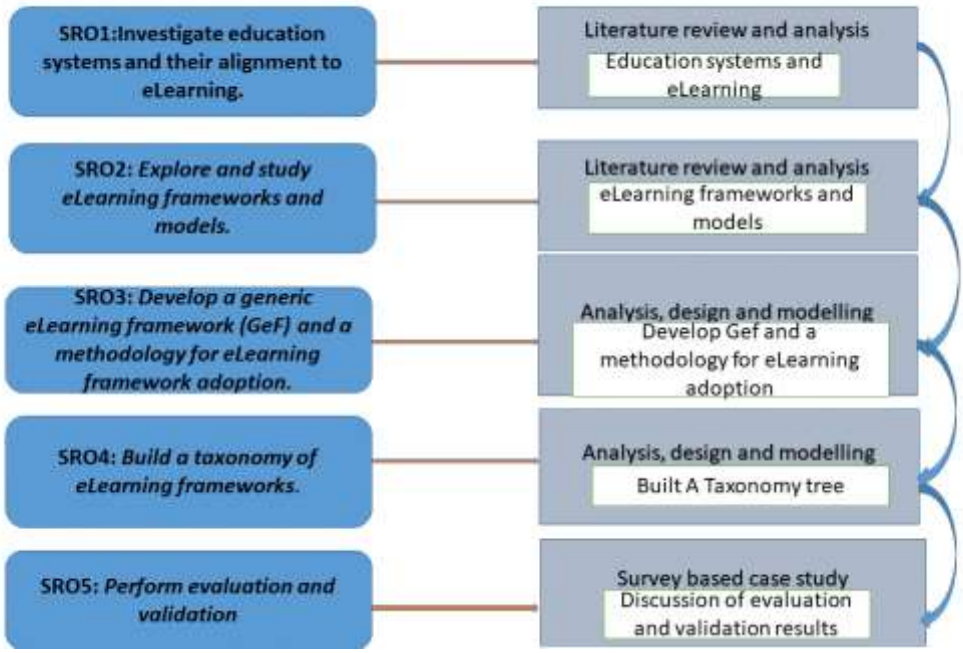

Figure 1-1: Research design steps

1.6.3 Research strategy

1.6.3.1 Case study

The case study method is a prominent qualitative analytic technique that entails a thorough examination of a social unit, such as a person, a family, an institution, a cultural group, or even an entire community. It is a method of research that focuses on depth analysis rather than broad. The case study emphasizes on a detailed examination of a small number of events or conditions, as

well as their interrelationships. A case study is essentially an in-depth examination of the specific unit in question. From cases, data generalizations and conclusions can be drawn (Kothari, 2004). A Case study is frequently used to create or test a theory utilizing an initial theoretical framework obtained from another theory, or to challenge an existing theory (Hagos, 2019); within a case study, several bases of data are triangulated, such as questionnaires, evaluation, documentary research, and interviews (Hagos, 2019). Case study is, therefore, selected as a proper research strategy for this research since testing of theory is a requirement of this research and also multiple data sources for triangulation purpose are used.

1.6.3.2 Survey

Another sort of research approach is a survey, which is typically used to generalize a population based on a representative sample of the entire population. Furthermore, the data gathered through this method of study can be analyzed using descriptive and inferential statistics to explain cause and effect relationships or test a theory. When compared to other forms of research techniques, the data acquired through survey strategy is unlikely to include a large range of data (Hagos, 2019). In this research, the survey approach will be used to cover wide area; to get the opinions of students and instructors from several different higher learning institutions in Ethiopia.

1.6.3.3 Survey-based case study

According to Saunders & Lewis (2009), it is typical to include a survey as part of a case study in a study. The survey-based case study strategy will also be used in this research so as to validate and evaluate the generic eLearning framework and the methodology for eLearning adoption. Furthermore, this strategy will be used toss investigate the current eLearning practice in some selected Ethiopian higher learning institutions.

With the aid of a questionnaire, interviews, observations and document analysis, students and instructors as well as the opinion of experts will be collected. The data from the questionnaire will be evaluated using SPSS with AMOS (Analysis of Moment Structures). On the other hand, with the use of Atlas ti 9 and Excel, the data from the interviews and other evidence will be content-analyzed to develop acceptable themes for measuring the study questions.

1.6.4 Research choices

A researcher must choose between qualitative, quantitative, or hybrid research approaches before collecting and analyzing data. Quantitative research is based on the measurement of quantity or

amount. It is applicable to phenomena that can be expressed in terms of quantity. Qualitative research, on the other hand, is concerned with qualitative phenomena, i.e., phenomena relating to or involving quality or kind. For instance, when looking at the causes for human behavior (i.e., why individuals believe or do particular things), we frequently use the term "motivation study," which is a sort of qualitative research. The goal of this form of research is to uncover the underlying intentions and desires by conducting in-depth interviews. Qualitative research includes attitude or opinion research, which is aimed to find out how people feel or think about a certain subject or institution. The qualitative research approach is commonly used to establish theories/hypotheses, gain in-depth insight, generate detailed descriptions of a phenomenon, and trade detail for generalizability (Rademaker, 2011). Quantitative methodology, on the other hand, is best for testing a model and generalizing findings, both theoretically and statistically. (Saunders, Lewis and Thornhill, 2012; Eisenhardt, 1989; Hagos, 2019).

Because qualitative approach excels at providing a deep understanding of a phenomenon, it has a high level of internal validity and can be used to create a theory. Quantitative approach, on the other hand, is better for testing theories and hypotheses. Therefore, because combining the two research procedures has a lot of value (Saunders, Lewis and Thornhill, 2012), this study will use both quantitative and qualitative research methods. The qualitative research will be used to get a rich understanding of eLearning frameworks and models to develop a generic eLearning framework, and a methodology for eLearning adoption from using a taxonomy tree. On the other hand, the quantitative approach will be used to validate the generic eLearning framework and to develop a methodology for eLearning adoption. It will also help to analyse the current eLearning practices and demonstrate the method of framework selection from the taxonomy tree.

1.6.5 Time horizon

Any research can be cross-sectional or longitudinal in terms of time horizon. Cross-sectional studies look at a specific phenomenon at a single time, whereas longitudinal studies look at a specific event or individual over a longer period of time. (Saunders, Lewis, and Thornhill, 2012). In the case of longitudinal studies, the same respondent is required for multiple sessions; however, one of the most significant hazards in this study is participant attrition. (Strangor, 2011 cited in Hagos 2019). Cross-sectional studies are frequently appropriate for a mixed-methods case study (Robson, 2002; Saunders, 2012 cited in Hagos 2019). As such, this cross-sectional study will use

different types of data collection methods at a particular time to answer the research questions and ultimately to achieve the research objectives.

1.6.6 Population of the study

For this study, the targeted population sample will be drawn from students and educators from government sector of Ethiopian higher learning institutes for the purpose of validation and selection of eLearning frameworks. Furthermore, some experts will be invited to participate in the validation of this study's conceptual deliverables. The government sector has been selected on the advice eLearning experts in different private and government institutions as suggested. The reasons being that the government institutions use eLearning more, and they are more easily accessible for collecting data because of political instability in Ethiopia. During the data collection period more than 40 government universities were operating in Ethiopia; however, only 10 were practising eLearning within the time frame 2016-2019 and they were mainly implementing it in the health colleges. These were universities listed as follows:

1)Arba Minch University (AMU); 2)Jimma University (JU); 3)Bahir Dar University (BDU); 4)Hawassa University (HU); 5)Haramaya University (HRU); 6)Mekelle University (MU);

7) Ethiopian Civil Service University (ECSU); 8)Adama Science and Technology University (ASTU); 9)Addis Ababa Science and Technology University (AASTU); and10) Gondar University (GU)

Among above 10, only the first six (Arba Minch (AMU), Jimma (JU), Bahir Dar (BDU), Hawassa (HU), Haramaya (HRU) and Mekelle (MU)) were better implementers of eLearning. In Ethiopian Civil Service University, eLearning is only being used for one common course. Others, like Adama Science and Technology, was in the preparation phase of implementing eLearning.

As a result, only four (1) Arba Minch (AMU); (2) Jimma (JU); (8) Adama (ASTU); and (7) Civil Service (ECSU) universities were purposefully selected to administer questionnaires to teachers, students and administrators in both an online and face-to-face basis to validate the generic framework. For the validation of the conceptual methodology for eLearning adoption instructors and experts in five institutions: (1) AMU, (2) JU, (3) BDU, (6) MU and (8) ASTU were randomly selected among the 10 universities. On the other hand, only two universities' namely (1) AMU, (2) JU and to some extent (8) ASTU were selected for the assessment of the current eLearning practice since this data is only needed for demonstration purposes.

The above selected sample universities are the pioneers and best implementers of eLearning among the above-mentioned ten best implementers. Furthermore, the instructors and students in these selected universities are more experienced in eLearning practice than the others. For these selections, the experts will be invited for validation and improvement of the frameworks.

1.6.7 Sampling

The targeted respondents will be sampled through a purposive sampling technique. Non-probability, deliberate, and judgment sampling are alternative names of purposive sampling. In this sort of sampling, the researcher selects the items consciously, and his or her decision on the items is final. In other words, under purposive sampling the organisers of the inquiry purposively choose a small mass out of a huge sample and this can be typical or representative of the whole (Kothari, 2004). Therefore, out of 10 universities that are practising eLearning, only FOUR were selected as the best and most experienced eLearning implementers among the 10. Then out of these selected universities, students and educators as well as administrators from eLearning departments were selected purposefully. Generally, 20 instructors (educators) and 80 students were expected to fill out the questionnaire for validation of the generic framew

In addition to the questionnaire and telephone interview with a total of 27 instructors, ICT directors and eLearning experts were made. For validation of the methodology for eLearning adoption, 115 questionnaires were sent to eLearning experts and interviews. This was followed with a random selection of nine of those experts to make a framework from a taxonomy tree. This will enable the researcher to conduct questionnaire-structured interviews for 20 technical staff (experts), ICT directors and teachers. The 295 questionnaires were administered online to 85 instructors and 210 students randomly from which a document analysis and observations were made.

1.6.8 Data collection method

In a case study such as this present one, many sources of data are triangulated, such as interviews, observation, documentary analysis, and questionnaires (Hagos 2019).

The methodology of this study is to gather first hand data through questionnaires, interviews and observations. Document analysis is used to collect secondary data. Three different kinds of questionnaire are developed and used to achieve the following three objectives: (i) validation of the generic eLearning framework, (ii) validation of a methodology for eLearning adoption, and (iii) assessment of the current eLearning practice.

Each of these slightly different questionnaires were distributed to students, instructors and experts. The questionnaires for validation of generic eLearning framework and validation of a methodology for eLearning adoption has two sections; section one is to hold several items to collect data about personal details of the respondents such as gender, age, level of education, department. Section two of the questionnaire is intended to measure teachers', experts' and students' attitude towards the generic eLearning framework and a methodology for eLearning adoption. One of the questionnaires has three sections: (i) one to elicit demographic data; (ii) the second to elicit data on how often the eLearning is used in different institutions; and the third section incorporates attitude questions. Apart from this, document analysis is the other technique that will be used to obtain secondary data in this study. This tool and observations are aided by different checklists that are added to the appendices.

1.6.9 Data Analysis Method

Analysis is a way of searching for interesting related patterns from large amounts of data collected (Cooper and Schindler, 2003). The analysis of data necessitates the use of categories to raw data

using code, table and then drawing statistical conclusions. The bulky data is summarised into groups and tables that are manageable for further analysis. Then the raw data is further classified into some determined and usable categories (Kothari 2004).

In this study, the analysis of the literature is conducted to enumerate common features of the identified frameworks and models. Both quantitative and qualitative data analysis will also be applied as needed. The Statistical Package for the Social Sciences (SPSS) with AMOS is employed as the software for quantitative data analysis. Under this software package, various tools for statistical analysis such as mean, standard deviation, frequency distributions, confirmatory factor analysis and the like will also be employed. Thematic content analysis is then utilized to analyze qualitative data received from the expert review using Atlas ti 9 software. Finally, results are presented in narrative, table and figure form. The questionnaire will have both subjective (essay-type or open ended) and multiple choice (closed ended) questions, but interviews and others will have only open-ended questions. The open-ended questions will be analysed using qualitative analysis tools whereas the closed ended, Likert scale type, questions will be analysed using quantitative, descriptive statistical tools.

1.6.10 Designing and validation of a framework

In this thesis, a generic eLearning framework, a methodology for eLearning adoption and taxonomy tree will be developed. Thereafter, the validation of the generic framework and a methodology for eLearning adoption is done through questionnaire, interview, observation and document analysis. Then, each institution's requirements will be collected and analysed to select a framework from the taxonomy tree based on their requirements. As already emphasised, after constructing the taxonomy tree and developing the framework, it is of importance to practically test and validate the findings. Hence, the case study will be conducted. In order to do so, appropriate data will be collected to get the requirements from students, educators and stakeholders. Then, the collected data will be analysed using descriptive statistics.

1.7 Contributions of the Study

This research has both applied and theoretical contributions. From a practical view point, the research will help to provide a logical classification of eLearning frameworks and models based on their characteristics and relationships. It is intended that this will contribute to assisting learning institutions to select and implement the appropriate eLearning framework.

From a theoretical point of view, the research will provide clarity in the organisation of eLearning framework/models since such a consolidated view does not exist in the literature. It will also bring a better and holistic understanding of eLearning models and frameworks that enable people to share and transfer knowledge within this area, and thus accelerate the development of this research area.

It is hoped that this research will serve other researchers as a springboard for further research in the field of taxonomy construction in the area of eLearning.

1.8 Scope and Limitation of this Study

This research assesses majority of the eLearning models and frameworks available in the literature and characterises them for the development of a generic eLearning framework and a methodology for eLearning adoption. Based on the building blocks of the generic eLearning framework a taxonomy tree is built. Finally, it is intended that the selection of the appropriate eLearning framework in the context of Ethiopia's higher educational institutions can be done with the aid of the taxonomy tree.

1.9 Generic Definitions of Terms

In the following section, definitions for a range of generic terms used throughout this thesis are provided:

- ***Education.*** Education has three meanings: learning process, learning product, and the discipline of researching learning process and consequences.
- ***Educational system.*** The system includes all the procedures, methods, and instrumental apparatus whereby a society organises and controls education in the various fields of human activity. The system is designed to maintain the functional and technical aspects and acceptance (ethical aspects) of the social structures and the values that justify education.
- ***Educational theory.*** This is an organized set of principles, generalisations and recommendations that guide educational thought and practice, especially in the areas of the curriculum and instruction.

- ***eLearning.*** This is a way of using IT tools in education and manpower training with the goal of decreasing transportation, saving time and money, and making learning more efficient.
- ***eLearning framework.*** This is a manual for planning, creating, delivering, managing, and evaluating eLearning programs.
- ***eLearning system.*** A learning management system (LMS) is a software package that combines communication capabilities, instructional tools, and evaluation features that make up the course's content.
- ***Models of eLearning.*** This refers to situations in which technology plays a specific function in assisting learning. These models can be articulated at two levels: pedagogical principles and detailed practice in putting those principles into effect.

1.10 Ethical Considerations

The types of topics studied by social scientists, as well as the methods they use to acquire valid and trustworthy data, may raise ethical concerns. A researcher needs to ensure that research procedures are designed to meet ethical standards. Apart from procedural ethics, a researcher must remember that ethics refers to how the research's goals, objectives, methods, reporting, and conclusions are consistent with ethical principles and practices (Kothari, 2004). The following ethical principles were followed to address ethical considerations in this research:

- obtaining acceptance in the research setting and gaining access to it;
- informed consent;
- study participants' confidentiality and anonymity;
- protection of participants from injury; and
- participate in the study on a voluntary basis.

Furthermore, all viewpoints and ideas presented have received full acknowledgement and citations.

In light of this, permissions to conduct research were gained from some selected eLearning higher education institutions of Ethiopia. Consent forms were signed by individual respondents to show their willingness to participate in this study. (For a copy of the approval letter see sample consent

form Appendix H). In the participant information sheet, participants of this study were also informed that they had the right to disengage from the research at any point in time. Then, an application for ethical clearance was submitted to the UNISA College of Science, Engineering and Technologies' (CSCET) Research and Ethics Committee and an approval certificate was granted accordingly (see attached Appendix I).

1.11 Outline of Chapters

The research will comprise the following chapters:

Chapter One – Introduction: This chapter contains introductory concepts of the research including background and motivation of the research, problem statement, objective and contribution of the study. In addition, it outlines the research approaches and discusses the research methodology in brief.

Chapter Two– Preliminaries on Education Systems and eLearning: This chapter provides definition of education and eLearning concepts, overview of education systems and eLearning in the world. Furthermore, alignment of the education system with the eLearning system are also discussed.

Chapter Three– eLearning Models and Frameworks: This chapter explores issues of various eLearning models and frameworks that are available in the literature. The investigation of eLearning Models/frameworks that provides characteristics of various eLearning models and frameworks are also covered.

Chapter Four – A Generic eLearning framework: This chapter entails the development of a generic eLearning framework, the derivation of existing eLearning frameworks from the generic eLearning framework and the development of a methodology for eLearning adoption as well as the maturity assessment of an institution with regard to a methodology for eLearning framework adoption.

Chapter Five – Taxonomy Construction: This chapter provides detailed definition and formalization of relationships of eLearning models/frameworks. The detailed step-by-step development of taxonomy is covered in the chapter.

Chapter Six – Data collection: Here, detailed steps of data collection for different cases of the research is discussed.

Chapter Seven – Data analysis and results: This chapter presents validation of the generic eLearning framework and a methodology for eLearning adoption.

Chapter Eight – Case study: Framework selection from taxonomy tree: This chapter assesses the current eLearning practice of some selected Ethiopian higher learning institutions. Then, follows the application of the taxonomy tree so as to determine the status of the higher learning institutions in Ethiopia.

Chapter Nine – Summary, Future Work and Recommendation: This chapter discusses the outcomes of the study, presents recommendation for adoption and /or future research directions in this area.

1.12 Chapter Conclusion

This chapter provides an overview of the research. Initially, a discussion introduces the advancement of ICT that brings new way of learning: namely, eLearning. This is followed by a discussion of a real-world problem in the area of eLearning as the background and problem statement of the study. Although it is agreed that eLearning is vital, still there are challenges on how to implement it. There is a plethora of eLearning frameworks discussed in the literature that again give rise to a problem of selecting appropriate eLearning framework for eLearning implementation in a particular learning institution.

To solve this problem, the development of a generic eLearning framework and then a taxonomy of these eLearning frameworks based on this framework is suggested as the objectives of this research. To achieve these objectives, different research questions are addressed by applying a literature review; a survey-based case study research strategy; and a mixed (quantitative and qualitative) research approach. Furthermore, the overall contributions of this research are also presented in this chapter. From a practical view point, the research provides a logical classification of eLearning frameworks and models based on their characteristics and relationships. In addition, from a theoretical point of view, the research provides clarity in the organisation of eLearning frameworks and models since such a consolidated view does not exist in the literature.

Next, the scope and limitations of the study are discussed. The scope of this study is to explore only eLearning models and frameworks available in the literature and characterise them for the development of a generic framework and then build a taxonomy tree. The definition of terms and ethical considerations are also provided in section that followed the scope of the study. This chapter

then concludes with the chapter outline of the whole dissertation. The next chapter covers educational systems and eLearning.

2 CHAPTER TWO: EDUCATION SYSTEMS AND eLEARNING

2.1 Introduction

It is an undeniable fact that to succeed in today's knowledge economy, governments everywhere in the globe must build an increasingly educated and talented workforce. That means there a well-grounded education should be in place to equip people not only for today's workforce but also with the ability to learn new skills for tomorrow's careers throughout their lifetime. It has been said that today's learners are digital natives. However, preparing students for lifelong learning necessitates new educational techniques that include technology as part of the learning process. While the necessity of 'reading, writing, and arithmetic' remains true, educators must use readily available technologies to engage and encourage students to take a more active role in their learning.

While the new way of learning might need a lot of attention, studying the past and current education systems is equally important since they are basis for developing a good model of electronically assisted learning (the new way of learning). There is no doubt that education systems of the past are the gateway to the present and the future. The present education systems are based on different learning theories such as behaviourism, cognitivism and constructivism that were developed many years ago. These theories also have an impact on the modern mode of education that is in electronically assisted mode. The electronically assisted education also ensures learners are socially interactive and collaborative. Some learning theories such as Constructivism also support this idea by suggesting that learning is a social practice that is enhanced by interpersonal interactions in a cooperative setting. In the Constructivist Theory, knowledge is formed when a person generates meaning from his or her own experience through social negotiation and the appraisal of the viability of individual understandings (Bichelmeyer and Hsu, 1999). The new way of learning is also based on a historical theory that learners were not empty vessels, blank slates, or passive observers. Moreover, the new way of learning is also in favour of the Cognitivist Theory as suggested by Alzaghoul (2012). The cognitive approach is about information transmission and processing; the mind should be opened and understood.

The purpose of this chapter is, therefore, to investigate education systems as the foundation of eLearning models. This brings an understanding of the education systems themselves before embarking on understanding how they can be technologically enhanced for electronic delivery to

learners. Furthermore, in this chapter, basic concepts of eLearning, its potential benefit and its current status in developed and developing countries are explored.

This chapter also enables us to achieve one of the objectives of this research, that is, the definition and discussion of basic concepts like education, education systems and eLearning. Section 2.2 of this chapter presents elements and characteristics of education, the current education systems with their limitation and benefit as well as educational theories that underlie the education system. In section 2.3 and 2.4, the chapter discusses a range of education systems available in developed and developing countries. The higher education system, technologies and learning theories are explored in section 2.5. In section 2.6, definition of eLearning, the potential contribution of eLearning, eLearning in developed and developing countries as well as learning theories and eLearning are discussed followed by section 2.7 which is the conclusion of the chapter. All the foregoing is of importance in building the foundational argument leading to answering the main research question of this study.

2.2 Overview of Education and Education System

2.2.1 Education

Different scholars point out that education has three meanings: i) learning process, (ii) learning outcome and (iii) the discipline of researching learning process and consequences. In the process of learning, there is transmission of attitudes, skills, and knowledge, these, in turn, will bring problem-solving behaviour that is the product of learning since it is through the learned skill, knowledge and attitude that individuals can solve problems. It is also through this process that the development of one's personality is achieved. Furthermore, education can be referred to as a discipline that can study how knowledge, skill and attitude are transmitted and how these factors can generate problem-solving behaviour. In other words, it is a discipline that can study the methodology of transmitting knowledge, skill and attitude.

In prehistoric communities, education was envisioned informally as a means of surviving by defending themselves against natural elements, animals, and other hostile humans in order to meet their basic needs for food, shelter, and clothing. All these struggles required the development of life skills, knowledge and values. Nowadays, education is important for not only human survival, but involves a much broader context in relation to the national, religious and political needs of a community. In today's world, education is mainly delivered in a formal, systematic manner through

private and public schools, institutions, and learning centers. The curriculum is either developed to meet national goals or to meet both religious and national requirements.

2.2.2 Education and educational systems

The Collins Dictionary (2021) defines ‘system’ as:

> A collective entity formed by a collection or mixture of linked, interdependent, or interacting elements; a methodical or coordinated assemblage of pieces, facts, concepts, and so on. In a system, there are interrelated components that are working together towards the achievement of a certain goal. Hence, system can be defined as a method of doing things, the manner in which people in society operate and carry out their regular duties. In the same dictionary, ‘educational’ is described as something connected to education, providing knowledge, instructive, or informative.

From the definition given above, one can deduce an educational system to be the coordinated or methodological assemblage of interrelated elements that enable people in a given society to carry out all activities relating to education. As a result, a country's education system includes not only the school system but also the administrative machinery in place to ensure that the school system runs well.

An educational system is also defined as:

> The procedures and methods, as well as the instrumental apparatus, by which a society provides organized and controlled education in various fields of human activity to its members for the purpose of maintaining (functional and technical aspects) and accepting (ethical aspects) social structures and the values that justify them. This word is sometimes used interchangeably with the term "school system”.
>
> (Muhammad, 2009, p, 21)

2.2.3 Distinctive education systems in the world

Educational systems in different parts of the world share certain commonalities and also some prominent differences. The socio-political culture in which a particular educational system is embedded is one of the distinctive factors of the system. Demirgüneş also states that variables including society’s requirements and state policies may trigger these different systems (Demirgünes, 2017). According to Rubenstein (2006), educational systems attempt to produce productive individuals who can participate in and contribute to their community; nevertheless, educational management, viewpoints and practices are defined in different ways. In other words,

all educational systems have a strong nationalist message but what varies is the way the message is transferred. Rubenstein (2006) further explains that effective educational practices are always rooted in a culture that is defined by a particular confluence of economic, political, social, and religious circumstances. What works in one situation may not work in another. Furthermore, these socio-political situations are dynamic and changeable, which will result in significant changes in educational institutions. For example, students who were educated in the former Soviet Union often sound like they are from completely different countries, depending on whether they attended school before or after the policies of Perestroika and Glasnost were implemented (Rubenstein, 2006, pp.433-441).

Thus, it is commendable to consider multicultural similarities and differences in the process of transforming policies and systems in a globalised world. Culture sensitive issues should certainly be considered to strengthen the distinctive nature of educational systems around the world. Mohammed (2009) states that each educational system adapts its own particular philosophy and as a result, various educational models are used in various countries. He further states that an education system is a reality in which external and internal forces influence its goals, structures, processes, contents, and methods. The externals are socioeconomic and cultural sources, while the internals are the system's inherent dynamics, such as teacher position, teacher-learner relationships, school-outside world relations, including family, media, local community, and business firms, and school management and administration.

Abbott (2014) also states that education systems, like the teaching profession, are by their very nature complicated and multifaceted, and the obstacles involved in reforming or enhancing them can be just as complex and multifaceted. Even improvements that appear to be simple, uncomplicated, or easy to implement may necessitate significant state policy changes, union contract discussions, and school scheduling changes in practice. This idea is further strengthened by the report of the US network for education information that identifies more than 190 separate systems of education in the world (Abbott, 2014). These systems support nearly 12 000 higher education institutions as well as numerous vocational, primary/secondary, adult, and specialized schools. National educational structures, cultures, and practices differ greatly, and each is governed by its own set of laws and procedures, as well as "some international duties." Much in the literature also asserts that teaching and learning practices vary widely across educational systems and across schools within systems.

2.2.4 Elements of an educational system

According to Abbott (2014), an education system comprises components that work in an interrelated fashion to produce the required graduates. For example: Some of the components of an education system are laws, policies, and regulations, public funding, resource allocations, and procedures for determining funding levels, State and district administrative offices, school facilities, and transportation vehicles, human resources, staffing, contracts, compensation, and employee benefits, books, computers, teaching resources, and other learning materials. Wallace, (2009, p,1) also states that an educational system is a complex system of inputs and outputs . Many such inputs are defined as: all attempts to influence the system by acting at fairly high levels of its hierarchy; non-profit foundations that offer money for special projects; private enterprise in the form of textbook publishers that dictate the "scope and sequence" of certain subjects in certain districts; state and local policymakers; national and state standards in various subjects; and local tax boards. Another aspect that affects the education system is parents' political involvement.

The output of an educational system is expressed in terms of a diverse group of people; doctor, every carpenter, parent, politician, businessperson, teacher, voter or engineer is an example of educational system's outcome (Wallace, 2009). Therefore, the output of an education system should be regarded as any individual equipped with skills and values that was obtained by going through such as system. In other words, a learner with no skills would enter a system, attend to relevant learning and assessment exercises and leave the system as a person with a set of learned values and skills. Furthermore, the outcome would also be considered as the impact such a learner will make on the socio-economic landscape after leaving the system through any form of political or societal commitment or formal employment within relevant institutions.

2.2.5 The quality of an educational system

According to UNESCO's (2005) position statement on quality in education, the emphasis is that the goal and subject of education should be to bring about social change in order to eliminate inequity and develop an egalitarian democracy. Furthermore, the notions of 'lifelong learning' and 'relevance' are particularly important. Science and technology should strongly be emphasised. Above all, improved educational quality would necessitate systems in which scientific progress and modernisation ideas could be acquired in manners that respected learners' socio-cultural surroundings (Naturwissenschaften & Beyene, 2010). Spreen and Knapczyk also suggest measures of quality education; namely, availability of free education, accessibility to all, acceptability of

content and delivery to all, and adaptability to respond to the need of learners (Spreen & Knapczyk, 2018).

Furthermore, for UNESCO, education is based upon the following four pillars:

- One of the pillars is learning to know, which recognizes that learners must construct their own knowledge on a regular basis, mixing indigenous and 'external' elements.
- Learning to do; is the second pillar that focuses on the hands-on application of what is learned.
- The third pillar is learning to live that addresses important life skills in an environment devoid of discrimination, where everyone has an equal chance to improve themselves, their families, and their communities.
- Learning to be, the fourth pillar, focuses on the abilities that people need to reach their greatest potential.

This conceptualisation of education provides a holistic and integrated picture of learning and, as a result, of what defines educational quality. (EFA Global Monitoring Report 2005 UNESCO, 2005).

2.3 Education Systems in Developed Countries

Education is also equally important for developed countries to make their social and economic development sustainable. In this section, the education systems of five selected developed countries were explored (France, Germany, Finland, Australia and Japan) to provide a summary of the findings.

2.3.1 Overall objective

The overall objective of education in developed countries is to provide the knowledge and skill necessary for life. In this case, education is expected to produce the citizen that is democratic, ethically responsible and who can promote equity in society as well as a love for his/her country and culture. In Germany, education is also required to shape young people into moral individuals, preparing them for occupational competence and political responsibility in the nation's autonomous and trustworthy service (UNESCO, 2012).

2.3.2 Structure and organisation

The structure and organisation of education in developed countries has little variation.

In Australia, for at least some levels of basic education, especially primary education, there is a legal provision for free and compulsory education. The average length of time spent in free and compulsory schooling is 7.7 years or the whole primary education (UNESCO, 2014). Then the structure is 7.7 years for primary education and 4 years for secondary (for both senior and junior).

In Japan, children will start the primary education at the age of 6 and will complete the primary education at the age 12 or at grade 6, it is compulsory. Lower secondary education is the final stage of compulsory education and is for students aged 12 to 15. Upper secondary level or college of technology is not compulsory. Upper secondary can be given in full time, part time and correspondence basis. So, the structure of Japan's education is 6 years for primary education which is followed by 4 years for lower secondary and upper secondary schooling after which a for college entrance education begins.

In France, primary education begins at the age of 6 and continues up to 11 years old. General secondary education is from age 11 to 18 of which the first years from 11-15 is called lower secondary and 15 to 18 years is called upper secondary.

In Germany, primary education begins at the age of 6 and it extends to the age of 16. Compulsory education is from the age of 6 to 16; i.e., all the primary education and general secondary (lower secondary education). Upper secondary or vocational education ranges from 16 to 19. In Germany, the structure of education is 10 years for primary education and lower secondary and after that upper secondary or vocational education may follow.

In Finland, for the age group 7-16 years, the comprehensive school (common school) provides nine years of free compulsory general education (primary and lower secondary).

2.3.3 Academic year and language

Academic year and language of instruction in developed countries is based on the context of each country. In Australia, the academic year runs from the end of January to the middle or end of December, with four terms starting at the end of January (mid-summer in Australia).English is also the language of instruction in Australia since the official and national language is English.

In Japan, the academic year runs from April 1 to March 31 of the following year. Except for a few upper secondary schools, all levels use a three-term academic year. The Japanese Language is the

national language and students take this language as a course in each level of study. Foreign languages like English are also given as courses.

In France, the school year stretches between 15 September and 15 October to beginning of July. The currently used language of instruction in all levels of education is expected to be French.

German is the language of instruction not only in Germany but also in some selected parts of Europe such as Switzerland and Belgium.

In Finland, September is the start of the academic year, and it finishes in May. It is split into two sections. Most schools in Finland use Finnish as a language of instruction, however a number of schools around the coast use Swedish language, which is also an official national language. (Marlow-Ferguson, 2002, UNESCO, 2012, the organisation of the academic year in Europe, 2015).

2.3.4 Challenges of teaching and learning in developed countries

Education is also equally important for developed countries to make their social and economic development sustainable. However, as indicated in the literature, challenges exist in the education system although they dramatically minimise the problems unlike developing nations. The widely known problems are lack of equity between the disadvantaged and advantaged groups of society, with some low achievements in the international tests (OECD, 2013). In countries like Germany some problems are of large class size and the resistance of the older generation of teachers to technologically assisted education (Bauer, 2010; MacDonald, 2006; Andell, 2008; Jones, 2011). In Finland, every challenge of the educational system is under control and it is believed that the system is the best among many others globally (MOE, 2010).

2.3.5 Instructional technology in developed countries

According to Seow et al (2005), the Australian Army has been using eLearning since 1987. In 1996, as part of its regular training curriculum, it got strategic help to build multimedia CD-ROM training packages. Japan is also one of the early adopters of the Open Courseware concept. Tokyo University and Kyoto University in Japan are the leading universities concerning MOOC (Massive Online Open Courses), which became popular in the year 2013 all over the world. WebCT4.1 Campus edition and Blackboard 6 are also the two leading eLearning platforms. The reason behind the lower rank of application of ICT for education is not attributed to the expansion of ICT infrastructure, but it is a matter of how to promote and advance the use of ICT infrastructure for

what they call a ‘lack of e-readiness’ (Suzuki, 2009,Aoki, 2010). Ducreau and Lauch stated that the University of Nancy 2 (UN2) in France, is now among the most innovative French Higher Education Institutions due to its investment in eLearning since 2007. In total it has 20 years’ experience in distance and open learning activities.

For Germany, the implementation and use of ICT began in the late 1990s. According to Gyambrah, (2007), most of the current eLearning products in Germany are enhanced by the blended or distance form and used to supplement existing programmes to make them flexible. The institutions that offer graduate, Masters and PhD degrees in eLearning mode are quite few. The majority of eLearning programmes focus more on the German-speaking countries than their local institutions that offer courses in the German language nationally. The state and federal government are the source of funds for the expansion of infrastructure and investments in eLearning in higher education. Commercial systems like Blackboard and WebCT, as well as open-source systems like Sudip, ILIAS, and Moodle, are the most widely utilized eLearning technologies in Germany right now.

According to Demiray (2010), in Finland, since eLearning has been a significant strategic focus of development in the Finnish education system for approximately 20 years, it has been driven through various strategies and development programmes. Since the beginning of the 1990s, the National Board of Education has placed a strong emphasis on ICT skills development. Finnish Virtual University (FVU) was created in 2001 as a joint endeavor involving all of Finland's universities that serves as a forum for universities to discuss their eLearning strategies. The FVU is a learning provider, an academic network, a technical service, and a laboratory for the development of ICT-based education. It serves both normal students and lifelong learners. Multidisciplinary research teams have been developing tools and resources to improve learning and teaching in Web-based contexts since 2001 (European Association for the Education of Adults (EAEA), 2011).

Table 2-1:Summary of the education system in developed countries.

Developed countries	Structure/organisation of the education system	Problem of equity	Large Class size	Less performance in PISA
Australia	7.7-4-tertiary	✔		✔
German	10-4-tertiary	✔	✔	
Japan	6-3--3-tertiary	✔		
Finland	9/10-2/3-tertiary	None	None	None
France	5-5-3	No	No	No

2.4 Education Systems in Developing Countries

In this section, educational systems of some selected developing countries are explored based on the basic elements mentioned above.

2.4.1 Overall objective

The overall objective of education in a developing country is to bring about full personal development; namely, the nation's moral, social, cultural, political and economic development. Education also contributes to the advancement of democracy, human rights, and the peaceful resolution of problems. The other objective of education in a developing country is also to achieve equity and quality in the education system. Furthermore, education is important to equip citizen to function effectively in their environment and to be useful members of the society. Promoting scientific thought and kindle the sprite of research are also the other goals of education in developing countries. Above all, in some Islamic countries, for example Saudi Arabia and Pakistan, the objective of Education is planting and spreading the Islamic religion; providing students with Islamic principles, teachings, and ideals; equipping them with varied skills and information; and developing their behaviour in a positive direction (UNESCO, 2012).

2.4.2 Structure and organisation

As the case of developed countries, the structure and organisation of an education system in developing countries varies depending on the context of each country. In Ghana, Primary schooling is obligatory and lasts six years. Lower primary and upper primary education are

separated into two three-year cycles, respectively. Following primary education, general secondary education consists of three years of junior high school and four years of senior high school education (6-3-4 structure).

In Ethiopia, Primary education lasts eight years (7-14 years) and is separated into two cycles: basic education (grades 1-4) and general education (grades 5-8). The secondary education has also two cycles, each lasting two years. The first cycle is from grade 9-10 and the second one is from 11 to 12, the overall structure is 8 years primary education, 2 years junior secondary and 2 years higher secondary. The Kenyan structure is similar to Ethiopia 8-2-2, but the elementary education is divided into lower primary (grades 1-3), middle primary (grades 4-5), and upper primary (grades 6–8).

In South Africa, primary education is divided into junior primary (1-3) and senior primary (4-6). Primary education is followed by lower secondary that is the last stage of compulsory education, it ranges from grade 7 to 9. Grade Reception (age 5) to nine is compulsory for South African citizens. Senior secondary education is from grade 10 to 12. The overall structure is made up of six years of elementary school, three years of junior secondary school, and three years of higher secondary school. In the case of Nigeria, the same 6-3-3 structure applies.

In Oman, basic education is divided into two cycles and lasts ten years. The first cycle is free and covers grades 1-4, while the second cycle is free and includes grades 5-10. Preparatory education is a three-year program that serves as a bridge between basic and secondary school (10-3).

In Saudi Arabia, children wait for six years for primary school. At the completion of grade six, students will take an exam and will receive elementary education certificate. The elementary year is followed by an intermediate education of three years (7 to 9 grades); then, intermediate school certificate will be given for successful intermediate education completion. Secondary education lasts three years (10-12 grades) and is the final stage of general education. So, the overall structure is 6-3-3.

In Kuwait, Primary education lasts 5 years (1-5) and it is compulsory. The second level of the education system is intermediate and preparatory education (lower secondary education), and it lasts four years, also it is compulsory. The successful completion of this cycle leads to intermediate school certificate, allowing access to secondary education (5-4-3).

For Pakistan, free and compulsory education is imposed from age 5 to 16. Primary education lasts five years and children start primary education at the age of 5+. A public test is held at the completion of Grade 5 for promotion to the next level and the distribution of merit scholarships to outstanding pupils. Secondary education is organized into three stages: middle level education (6–8), secondary education (9–10) (which includes the humanities, science, and technical streams) in high schools, and higher secondary education (which includes the humanities, science, and technical streams) (Grades 11 and 12).The overall framework is (5-5-2) (Bauduy, 2008; UNESCO, 2012).

2.4.3 Academic year and language of instruction

The academic year and language of instruction in developing countries may vary depending on the context, but generally, the academic year (school year) stretches on average from 38 to 45 weeks and two to four semesters. Regarding the language of instruction, the majority of developing countries use the language of the immediate environment (local language) up to grade three, but it extends to grade eight in the case of Ethiopia. Similarly, Arab countries like Saudi and Kuwait use the Arabic language for all levels and they teach English as a second language. Similarly, Pakistan uses Urdu at all level and Urdu and English are taught as a second language in parallel (Marlow-Ferguson, 2002&UNESCO, 2012).

2.4.4 Challenges of the current education system in developing countries

Although it is hard to draw absolute generalisations based on the literature reviewed for some developing countries, the following main conclusions can be drawn:

From 2007 to the current year, a significant body of research has shown that education systems of developing countries have a varied structure and language of instruction. Irrespective of that, they shared some common problems regarding their learning environment and instructional methods. These are: large number of students, inadequate number of teachers, inadequate resources, the problem of equity, teacher-dominated classroom (a traditional mode of top-down teaching), unbalanced student-instructor ratio, untrained teachers, lack of teacher and students' motivation, and poor English language skill (Aheto-Tsegah, 2011; Rehman and Khan, 2014; Kwofie and Henten, 2011; Serbessa, 2006; Motitswe, 2012; Olufemi *et al.*, 2018; Suresh and Kumaravelu, 2017). Therefore, it can be deduced that the dominant learning theories behind the education systems of these countries are behaviourism and cognitivism since their main emphasis is on

providing knowledge to the learner. It is assumed that the teacher is the main provider of knowledge (behaviourist) and the learner is regarded as a data processor. (like a computer), as a result, memory, motivation, thinking, and reflection all play a role in learning(cognitivism). A Constructivist Learning Theory that emphasises active, participant-based learning is rarely seen in their instructional strategy. The above-mentioned problems do not allow constructivism to be implemented unless it is facilitated by technology. The literature to date has observed that a well-designed, technology-assisted education can drive constructivism.

2.4.5 Instructional technology in developing countries

In general, government policies and strategies in developing countries emphasise the importance of ICT but they are slow to implement this in education and other sectors. The study explores some examples of ICT implementation in several developing countries.

According to Asabere and Brew (2012), The Ghanaian government is having challenges in funding tertiary education. As a result of this and other factors, Ghana's government has recognized distant education as a viable alternative to traditional face-to-face education. This step is motivated by the belief that all Ghanaians, regardless of where they live, should have access to all forms of education and training. In Ghana, certain tertiary institutions use eLearning[1] and distance learning[2]. Other institutions outside of Ghana (particularly the United Kingdom, Denmark, and Malaysia) also offer distance education and eLearning programs in Ghana (Asabere and Brew 2012). Two of these institutions are the Kwame Nkrumah University of Science and Technology (KNUST) and the University of Ghana (UG) that have unbiased access for the growing number of individuals seeking education at the tertiary level. The Government of the People's Republic of China (PRC) also provided significant grants and loans to the University of Ghana to equip their Institute of Distance Education with the required hardware, software, and other accessories to implement ICT-based Distance Education. Furthermore, other institutions are currently providing education via an electronic approach such as Aalborg University in Ghana with UNIFLEX eLearning system, University of Applied Management (UAM), Ghana Campus, with UAM Learning Platform; Accra Polytechnic, UK, with the BLACKBOARD eLearning platform.

[1] eLearning - a method to apply IT tools in education with the aim of reducing movement, time and cost savings.
[2] Distance learning - a mode of transferring knowledge where the learner and the teacher are in separate place.

In Ethiopia, ICT is considered as the key enabler for the implementation of the country's development programme. The ICT–Assisted Development Program (ICTAD) with Ethiopian Telecommunication Corporation and other Ethiopian IT companies enable the following eLearning platforms to be available despite the challenges that prohibit them to perform up to the plan. These platforms are:

- UniversityNet: Twelve Ethiopian universities have been networked and are now being gradually equipped with eLearning centres.
- SchoolNet: 500 secondary schools have already joined SchoolNet (including technical and vocational education and training TVET schools). This network is being increasingly supplemented by eLearning centers via a VSAT (very small aperture terminal) technology.

Among the challenges of the limited telecom infrastructure are the low level of computerisation especially outside the capital of Ethiopia and the lack of human resources (Alemu, 2017).

For South Africans, policies that emphasize on the importance of ICT, enable familiarity with at least computer literacy abilities, information management skills, communication, and analytical skills (Mlitwa, 2006). In the process of enhancing usage of ICT, in 2004/5, all universities in the Western Cape adopted different LMS (learning Management systems). Educators at the University of Stellenbosch were forced to use a proprietary learning management system called WebCT. In reality, however, while there is widespread usage of the eLearning system the engagement of academics with the system is very minimal. WebCT is also used at the Cape Peninsula University of Technology. Despite the lack of a policy or forum for users to discuss system selection, the LMS is employed as a learning transfer medium in both schools. Generally, therefore, the adoption of ICT is rising in South Africa though discrepancies exist between the implementation of a technology (or system) by institutions and there is also variation in usage patterns by academic staff. Apart from the above enhancement of ICT, South African institutions are with some obstacles including a struggle to engage even at a social network level, top-down impositions of eLearning policies, limited understanding of the benefits of an LMS accompanied by academic resistance to change, a lack of engagement at any level, and limited time to engage technology and pedagogy (Mlitwa, 2006).Furthermore, Ojo and Adu, (2018, p.7) have stated more recent challenges of ICT in education of South Africa are: the lack of adequate policy, inadequate

knowledge on user of ICT in education, inappropriate management support on usage of ICT, lack of proper training for ICT users in education, lack of incentive, and large class size, among others.

For Nigeria, the reactivation of the suspended NOUN[3] system was necessitated by the need to take advantage of developing innovations in ICT that have transformed the strategies and methods of instructional delivery in the remote learning mode (Ajadi, Salawu & Adeoye, 2008). In Nigerian schools, the most common type of eLearning adopted is CD-ROM based lectures that are non-interactive but they can be played whenever the learners desire. Some institutions adopted the use of intranet facilities; however, this is not well maintained because of the never-ending energy power problem and high cost of running electrical power generators. Most students in Nigeria go to the cybercafé; but this is not multimedia interactive. Education is not possible through the net because of diverse activities taking place therein as well as the bandwidth problem. Despite the obstacles that eLearning faces in Nigeria, educational institutions such as the University of Ibadan, Obafemi Awolowo University, University of Benin, University of Abuja, University of Lagos, and the Nigerian Open University have eLearning facilities. When compared to other parts of the world, the number appears to be quite low when considering its importance for economic development; however, it is believed that implementation of eLearning has a significant role to address other strategic areas; namely, access, quality, equity, technology and innovation.

Kenya's education sector vision for 2030 aims to provide globally competitive quality education, training, and research for long-term growth. (Tarus, Gichoya and Muumbo, 2015). Kenyan state universities have also implemented eLearning projects. The majority of Kenyan universities are already employing eLearning, though generally in a blended mode.[4] For instance, in 2004, a well-tested eLearning platform called Wedusoft was implemented at the University of Nairobi. Jomo Kenyatta University commenced the eLearning mode of teaching in 2005 and is currently using Moodle as an eLearning platform. Likewise, eLearning programmes have also been in operation at Jomo Kenyatta University of Agriculture and Technology since 2006 with Moodle as an eLearning platform. Implementation of eLearning in Moi University started in 2007 with MUSOMI, a customised eLearning platform. However, it is seen that there is a meagre progress in use of an eLearning approach in these public universities due to unforeseen challenges. Most

[3] NOUN refers to National Open University of Nigeria

[4] Blended mode refers to a mode of education delivery that mixes both face to face (traditional) and eLearning methods.

universities are using eLearning in blended mode and have lagged behind in full implementation. As a result, in March 2012, there was an attempt to support eLearning projects in Kenya by the British & Foreign School Society (BFSS) and by the New Partnership for Africa's Development (NEPAD) schools in Kenya, which were set up as centres of excellence in Information and Communication Technology (ICT) integration.

For teachers and faculty members to go online, the Internet and other forms of eLearning platforms are being introduced and extended into Omani educational systems. Many educational institutions have also deployed learning management systems such as WebCT, Moodle, and e-portals. eLearning in Omani is becoming publicized and popularized, and lecturers are being encouraged to post their lectures online. Most Omani educational institutions have recently adopted electronic learning, in which educational and training programs are delivered to students via the internet at a distance. Some Omani higher education institutions are linked with universities in India, the United States, the United Kingdom, and Australia, through which they offer distance learning courses and programs to their students. Virginia Tech, for example, will serve as an educational adviser and a partner in the establishment of a new university that will primarily focus on science, business, and engineering. Secondary students who did not have the opportunity to learn basic computer skills can enroll in the International Computer Drivers' License (ICDL) program to gain fundamental IT abilities before continuing their study. To date, approximately (370) authorized school-based training centers with ICDL certified teachers have been established to far. At around (18) ICDL approved testing sites, over 100,000 students have been trained and tested (MOE, 2008 cited in Al Musawi, 2010). In addition, the Ministry of Education has designed inclusive educational portal and it is presently at the trial stage. The portal allows for the creation of a centralized electronic repository of information about pupils enrolled in Omani public and private institutions. The Internet, email, and SMS are used to facilitate interaction between administration, teachers, students, and parents. Students would be able to transfer classes with better learning efficiency as a result of this integrated data management (ITA, 2007; Al Shanfari, 2007 cited in Al Musawi, 2010). In 2005, Sultan Qaboos University's college of education established a new department to train information technology teachers, offering a bachelor's degree in instructional and learning technologies. In 2009, the first class of graduates from this department began working (Al Musawi, 2010).

For Saudi Arabia, distance education is largely used in public and higher education settings where gender segregation is essential. Male professors can only teach female students via remote learning methods including closed-circuit television, one-way video, two-way audio, and broadcast. In 2007 and 2008, the Faculty of Distance Learning at King Abdul Aziz University in Jeddah was established and began to operate as a distance education centre for the western part of the country. Al-Imam Muhammad ibn Saud Islamic University is the other distance education centre and it was designed to offer four years of distance learning courses leading to a bachelor's level degree. Saudi Arabia has not yet offered the opportunity to private institutes to practise distance education except the AOU (Arab Open University). The Arab Open University, which started in Kuwait, Jordan, and Lebanon in 2002 and has since expanded to Saudi Arabia, Bahrain, and Egypt, has received accreditation from the Ministry of Higher Education and the National Commission for Academic Accreditation and Assessment (NCAAA). The AOU uses a Moodle-based learning management system, interactive multimedia lectures, face-to-face lectures, practical workshops, and books to teach students. The Knowledge International University is also a private institution and was launched as a first virtual university in Saudi Arabia. It offers a degree programme and in the year 2008, it had students in Saudi Arabia, Egypt, Jordan and Morocco. The Ministry of Higher Education has yet to authorize online distance education given by such multinational colleges. However, some Saudi students do enrol in courses offered by University of Phoenix Online, the largest privately acknowledged university in the US. In 2008, the MoHE also launched the Google Educational Programme. Personal emails, access to office applications, program schedules, and personal webpages are provided to participants in this effort, which presently includes 1200 schools and over 20 000 instructors. In addition, the Ministry of Higher Education has inked Memorandums of Understanding with Intel and Microsoft to build a number of educational, training, and eLearning programs for students and teachers that will help them transition from school to the information society.

In Kuwait, strategies are also developed to facilitate the implementation of eLearning. The strategic vision for eLearning is launched within the framework of public education in Kuwait from 2005 to 2025. The Ministry of Education in Kuwait has launched several strategic projects that can enhance the development of the information technology sector and use of IT in the education sector. Kuwait's educational portal that can provide educational resources for students, information and administrative services is also the ongoing project. Furthermore, electronic

content as well as data centre projects that are the first among the Middle East countries are the other projects planned to enhance the IT sector (Mohammed, 2014). However, all of the aforementioned paths forward are simply a qualitative step toward developing Kuwait's learning and education process, as no genuine executive measures have been done yet, with the exception of the first step, which is the infrastructure project, which was finished in 2011 (Ghaith, 2013).

In Pakistan in 2000, a national strategy of "Education for All" was introduced and it was believed that it cannot be implemented without new, innovative technological ways of transforming the traditional education system (Qureshi et al., 2012). Thus, eLearning was proposed as an alternative to fill that gap. The Virtual University of Pakistan was founded with the goal of providing education to full-time working professionals in all parts of Pakistan through eLearning and traditional methods, as well as face-to-face meetings, to fulfil their needs. However, some research in the literature argue that the implementation of this system is full of challenges and limitations (Qureshi et al., 2012). According to Sana & Mariam (2013 cited in Ahmed, Hussain,and Farid, 2018), many public and private institutions, such as Virtual COMSATS (Commission on Science and Technology for Sustainable Development in the South) also offer eLearning. Both the University Virtual Campus and Virtual University of Pakistan (VUP) provide synchronous[5] and asynchronous[6] learning approaches. ICT is used by the VUP in the form of multimedia/graphic software, online teachers or trainers, video conferencing, and cell phones. As a result, the Virtual COMSATS University Virtual Campus is one of the fastest-growing eLearning institutions in Pakistan, offering higher education through its study centers, which offer instructional assistance, computer and internet access, and study materials. ICT tools include the LMS and satellite technology. Video lectures, handouts, course information, eBooks, live sessions, assignments, quizzes, lab sessions, SMS service, and email service are all examples of ways to deliver instruction through the LMS. Cell phones and video conferencing are also helpful to the students. The UNIDO (United Nations Industrial Development Organisation) has also contributed to the economic and industrial development of the country by applying up-to-date technologies such as eLearning and by the forming partnership with the Ministry of Science and Technology to establish a Virtual University in Pakistan. So, the Virtual University was established with the co-operation

[5] Synchronous method allows various audiences from different place to communicate at the same time

[6] Asynchronous method allows various audiences from different place to share information, but not at the same time

of UNIDO. The Virtual University offers bachelor's and master's degree programs in a variety of fields, including computer science, business administration, commerce, public administration, and psychology. The university also provides a number of diploma and certificate programs. A hybrid model of eLearning along-with TV channels and LMS are the approaches used, however, the university is also working in partnership with a number of private institutions in several district headquarters.

Table 2-2: Summary of the education system in developing countries

Name of Countries	Structure of the education system	Inadequate teachers	Inadequate resource	Equity problem	Teacher-dominated (traditional mode of teaching)	Large Class-size	Untrained teachers	Lack of teacher and student motivation	Poor English lang. skill
Ghana	6-3-4-tertiary	✓	✓	✓	✓	✓	✓		✓
Ethiopia	8-2-2-tertiary	✓	✓		✓	✓			
Nigeria	6-3-3-tertiary	✓	✓		✓	✓	✓	✓	
Kenya	8-2-2-tertiary		✓	✓	✓	✓	✓	✓	
Oman	10-3-tertiary		✓	✓	✓			✓	✓
Saudi	6-3-3-tertiary				✓		✓	✓	✓
Kuwait	4/5-4-3-tertiary		✓		✓			✓ (students)	
Pakistan	5-5-2-tertiary	✓	✓	✓	✓			✓	

2.5 Higher Education Systems, Technology and Learning Theories

This part of the literature gives a summary of the current higher education systems. The current status of the higher education system is discussed, and the nexus between the knowledge economy

and higher education expansion is also discussed. A summary of learning theories, such as Cognitivism, Behaviourism, and Constructivism as the dominant learning theories and learning approaches behind the current higher education system are also elaborated in this section. The role of technology on the current higher education is discussed first.

2.5.1 Overview of higher education systems

The emergence of the knowledge economy and the demand for skills has had three effects: i) it has necessitated the expansion of higher education in all countries, (ii) it has encouraged the migration of skills from developing to developed countries, and (iii) it has facilitated cross-border education (i.e. the mobility of learners, institutions, and programs).In line with this, the ICEF (International Consultants for Education and Fairs) Monitor, 2018 reported that the overall number of students in higher education is likely to reach roughly more than 216 million as of 2016 and projected to 594 million and above by 2040. This large growth in enrolment represents a strain for public higher education, and because of this, the private sector and cross-border institutions have developed quickly and are increasing their share of higher education enrolment. As a result of this trend, the burden of financing higher education has shifted from the public to the private sector. There is also an increase in the number of institutions and programs, which has a negative impact on the quality of higher education. Despite the creation of national certification institutions by governments, quality remains a critical concern in many countries. One of the challenges is developing approaches that can ensure equity and quality (Mensah, 2020) and the government should be involved in formulating policies and strategies to promote equity, ensure quality, and regulate the operation of numerous higher education agencies. Even while the state's involvement in supporting higher education financially may be diminishing, the state's regulatory role continues to grow (Varghese, 2011).

2.5.2 Learning and Education Theories

2.5.2.1 Definition of Educational Theory

Different authors have defined educational theory (Moore 1977 & Nwosu, 1987 cited in UNESCO 2009-2014) as an organized set of principles, generalisations and recommendations that guides educational thought and practice, especially in the areas of curriculum and instruction.

Education theory covered topics such as pedagogy, andragogy, curriculum, learning, and education policy, organization, and leadership. History, philosophy, sociology, and psychology are also all

disciplines that contribute to educational thought. For instance, the Behaviourist Theory of education is derived from psychology and it is about how education is aligned with the behaviour of learners. As the UNESCO 2009-2014 Report states, Education theory is a wide and deep area of study since it is derived from different thoughts and disciplines. Hence, to be specific learning theories are given attention and discussed in this study.

Bélisle (2008) also strengthened the above idea and argued that more knowledge about learning has been produced in pedagogical research than knowledge about teaching. It's worth noting that while there are learning theories, there are no teaching theories. Only models are related with teaching. A theory explains and organizes the elements involved in a consistent and stable manner. A model is a theory based on a problematic situation that has been reframed to solve the issue. A learning theory is a systematic and logical explanation of how learning occurs. The learner's role and activities in the learning process can be determined using a learning theory. The actions of teaching and the outcomes of learning are also determined.

Several classified schemes of learning theories have been made and described in literature such as behaviourism, cognitivism and constructivism, among others. The Behaviourism Theory is concerned with behavioural transformations that occur as a result of learning, in which a new behavioural form is repeated until it becomes automatic. Cognitive Theory is concerned with learning-induced changes in a student's understanding. The Theory is based on student-organized schemata structures regarding a perceived environment. In constructivist theory, learners' active participation and reflection are emphasized. A learner has the freedom to select his or her preferred method of instruction. These theories can be embedded in different subjects so as to facilitate acquisition of skills and knowledge. They can also be simultaneously combined into a single discipline or subject relying on the expected learning product and the level of study (Zhang & Nunamaker, 2003 cited in Hodges, 2009).

Alzaghoul, (2012) states that the three commonly known learning theories fall under the category of Behaviourism, Cognitism and Constructivism. Behaviourism concentrates solely on the components of learning that can be observed objectively. Constructivism views learning as a process in which the learner actively creates or builds new ideas or concepts, whereas cognitive theories seek beyond behaviour to explain brain-based learning.

Learning, according to behaviourism, is a change in observable behaviour brought about by external stimuli in the environment. In line with this, Skinner (1974 cited in Alzaghoul, 2012) argues that there are no scientific methodologies that can be used to prove the inner processes. As a result, researchers should focus on "cause-and-effect relationships" that may be established through observation. Furthermore, according to behaviourists, it is the learner's visible behaviour, not what is going on in his or her head that determines whether or not the learner has learnt something. The Objectivist worldview supports behaviourists, arguing that learners 'acquire' information from external resources by participating in learning activities. According to the behaviourist viewpoint, learning is a process of making oneself active in the search for and acquisition of knowledge. Teachers are likewise assumed to be knowledge providers by the behaviourist. (Alzaghoul, 2012 & Alemu, 2017).

In Cognitivism, the emphasis is on what is on the mind; the mind should be opened and comprehended since it is believed that learning is an internal process rather than an external behaviour. The learner is regarded as an information processor (like a computer). According to cognitivists, learning necessitates the use of memory, motivation, reasoning, and reflection. It is the processing capacity of information, the depth of the processing, the amount of effort used during the learning and the learner's existing knowledge structure that determine the amount learned. The Cognitive school takes into account that there are individual differences among learners and emphasises the importance of varied learning tactics in online instruction to address those differences. Individuals, according to cognitivists, have their unique learning styles, or different ways of perceiving, interacting with, and responding to the learning environment (Alemu, 2017).

The assumption of constructivism, therefore, is constructivists value situated and contextual learning because there is a strong building of new information based on a learner's prior practice. The role of a teacher in the constructivist approach is beyond observance and assessor who is expected to engage with the students while they are doing activities, for example, by questioning them. Constructivists believe that learners should be vigorous rather than submissive, and that they should be at the center of the learning process, with the instructor in an advisory and facilitator role that will inspire learners to arrive at their own type of the truth, influenced by their experience, culture or rooted worldview. Learning should be a dynamic process and should allow learners to

put on information in real world conditions, simplify personal analysis of learning content, talk about topics within a group and evaluate.

In constructivist theory, moreover, it is believed that the human mind constructs reality rather than reproduces reality from the outside world directly. It is also believed that there is no public reality; rather, it is through social negotiation and individual understanding evaluation, learners actively develop their own knowledge based on their experiences. According to this school of thought, learning is context dependent. Also, since learners are assumed to be in active environments, and should get the chances to experience cognitive conflict such as 'puzzlement' in order to develop new schema or understanding. So, teaching-learning in this case is a process of supporting the construction of knowledge rather than communicating knowledge (Alzaghoul, 2012; Alemu, 2017).

Later in the 20th century, role of context, particularly social interaction was considered and over emphasised. Then, constructivist view of learning was shifted to socio-constructivism. In the socio-constructivism environment, there was criticism against the information-processing constructivist approach. This criticism became stronger since this approach considers knowledge as self-sufficient and independent of a context. In the new view, knowledge is considered situated and is a product of the activity, context, and culture in which it is formed and used; cognition and learning are understood as interactions between an individual and a situation. This adds a new meaning to learning, namely, "participation" and "social negotiation." (UNESCO 2009-2014).

2.5.3 Technology and the current status of the education systems

According to Ananga (2020), globalisation, information and communication technology, and the resulting economic upheavals have an impact on the function of education and training. Traditional educational methods are no longer enough to meet the training needs of a knowledge society. In a globalised world, competitiveness is expressed in terms of the educational level of human resource that a country has, so education should play a significant role towards bringing adequate and qualified educated human power. As recommended by many scholars, the use of technology in education has a lot of promise to change people's lives. Owing to this, countries embrace eLearning since it can produce improved educational outcomes though many may face challenges in the implementation process. Among others, an unclear plan, limited knowledge of all the pre-

requisites for success and lack of well-organised strategy are mentioned as some of the challenges many countries face in the implementation process of eLearning (Charlton-Laing & Grant, 2012).

2.6 eLearning

All forms of electronically supported learning and teaching are included in eLearning. It also has undeniable potential to provide high-quality education to everyone, everywhere. This makes the adoption of eLearning a choice of necessity in this age of knowledge economy that demands an increasing educated and skilled work force. As a result, despite problems such as insufficient infrastructure, strategy, and pedagogical issues, there is broad adoption of eLearning in higher education.

2.6.1 Overview of eLearning

According to Alshaher (2013) the current status of eLearning is the result of an evolution that began some 40-plus years ago. The following diagram depicts the transformation of eLearning from the 1970s to the current time.

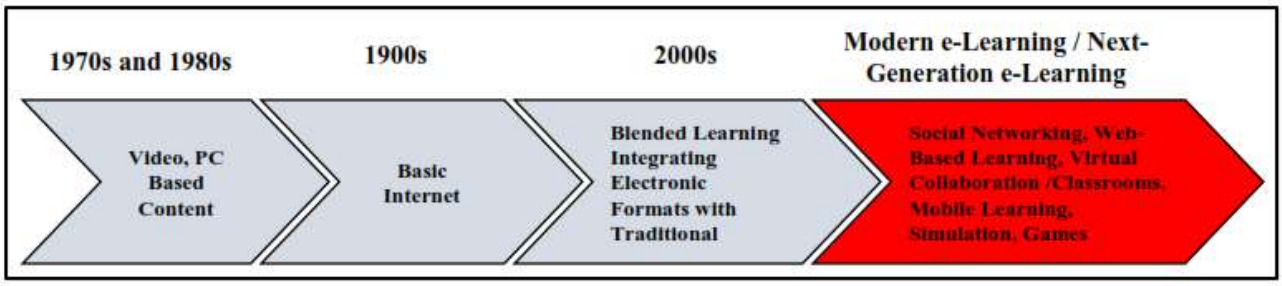

Figure 2-1: The evolution of eLearning from the 1970s to the present (Alshaher, 2013).

It is also documented that distance education that can be traced back to the 18th century as the initial point for today's interactive eLearning. According to Lorenzo García Aretio (2001 cited in ,Gyambrah, 2007) the evolution occurred as follows:

- ***Correspondence teaching*** laid the base for eLearning in 1728, when Caleb Philipps, a professor of shorthand, advertised in the Boston Gazette that he was offering instructional materials and seminars for correspondence teaching. However, Isaac Pitman launched a shorthand course in England in 1840, which was the first evidence of an organized correspondence course with bidirectional communication. Correspondence institutions arose in the United States and other European countries from those early phases.

- ***Multimedia teaching*** took off when the British Open University was formed in the 1960s. Here there was use of printed materials with audiotapes, videotapes, radio, TV broadcasts, and telephone, among others.
- ***Telematic teaching*** emerged in 1980s, a decade that highlights the introduction of modern telecommunications into the education sector. In 1984, computer-based training was launched with the aim of giving training for computer professionals (Jay Cross, 2004). Then, CBT Systems then transferred all of its courseware to CD-ROM in the mid-1980s, when it became the new training technology. As time passed, CDs become compared to live instructors lost favour and students became disinterested in studying alone without instructors
- More recently, ***teaching through the Internet*** and eLearning emerged, it is now considered as the fourth-generation distance teaching, virtual campus, virtual teaching, and flexible learning model, among others. It encompasses the application of bi-directional communication and included ICT-supported instruction which rapidly became the most popular in the 1990s due to the wide-spread use of the World Wide Web. This caused the emergence of web-based training in 1998. Thereafter, we are experiencing significant expansion of delivering content over the Web, personalised learning portals, tracking systems, online newsletters, discussions groups and so forth.

2.6.2 Definition of eLearning

eLearning is defined as "teaching and learning delivered over the Internet, the World Wide Web, or an intranet." (De Villiers 2006). eLearning is a means of using IT tools in education and personnel training to reduce transportation, save time and money, improve and assist learning (Nejad, Nejad & Sadeghijoola, 2012).

It is also defined as any style of learning that relies on or benefits from electronic communication through the use of the most up-to-date information and communication technologies. Similarly, “a broad phrase that refers to a variety of ICT-based applications and processes, including as computer-based learning, web-based learning, virtual classrooms, digital collaboration, and networking.” (Fredrick, 2015, p. 19)

It is also referred to as web-enabled instruction and learning. Building on the above descriptions the *eEurope: Promoting Digital Literacy initiative* describes it as the “the use of modern

multimedia technologies and the internet to improve learning quality through access to resources and services, as well as long-distance collaborations and exchanges”

eLearning is also defined as all procedural kinds of electronically supported learning and teaching that aim to influence the production of knowledge with reference to the learner's specific experience, practice, and knowledge. Whether networked or not, information and communication technologies serve as unique media for implementing the learning process.

As a result, eLearning is fundamentally a computer-assisted, network-assisted transfer of skills and knowledge. Web-based learning, computer-based learning, virtual classrooms, and digital collaboration are examples of employing electronic applications and processes to learn. Content is given via the internet.

2.6.3 The potential contribution of eLearning

According to Olson, Codde and Tarkleson, (2011) eLearning is a broad phrase that refers to a variety of educational methods, technological platforms, and administrative procedures. Despite program challenges of rapid development of technologies and the educational applications and also challenges of how to use the technology, it has important potential contributions for an educational system as follows:

- It solves teachers’ shortage, particularly in scientific and science-related fields, by delivering high-quality teaching resources such as films, interactive software, or information from the internet or a local computer.
- eLearning also addresses the scarcity of learning materials such as textbooks by making materials available on portable devices such as e-readers or mobile phones. Quizzes and games through eLearning can help students learn and understand more. By promoting interactive, communicative eLearning for the development of skills in students (so-called "21st Century Skills") such as critical thinking and problem solving, communication, collaboration, and creativity, improved informational content and learning approaches can improve education quality.
- eLearning also assists students in gaining information and communication technology skills (Ojo &d Adu, 2018) that enable them to contribute to their countries' knowledge-based globalised economies.

- Additionally, according to Davies (2004), eLearning allows learners to access critical knowledge at a time and location that is convenient for them, because eLearning content can be quickly reviewed, and multimedia presentations can be enabled as follows:
    - Online presentations can be enhanced with eLearning, allowing learners to deliberate on concepts at their own speed. It also enables access to a variety of online resources.
    - Self-directed learning can be aided through eLearning through online simulations and tutorials, which builds learners' confidence to pursue formal learning possibilities.
    - Prior to face-to-face sessions, learners' evaluative abilities can be enhanced through activities based on online resources. Through collaborative technologies that can stimulate reflection and evaluation outside of class contact time, eLearning can enhance asynchronous, peer-to-peer learning.

2.6.4 The Impact of eLearning on Education and Society

In addition to the advantages mentioned above, interactive eLearning has impact on students' achievement by motivating them to learn especially underachieving students. Besides, the tutorial given via eLearning system improves students' performance and can also have a positive impact on teachers by making the teaching-learning process students-centered. This again enables teachers to gain confidence, self-esteem and motivation as teachers can improve ICT skills as well as ICT-related pedagogical skills through eLearning.

Furthermore, eLearning has also impact on the economy; the improvement in education positively affects the increment of GDP and increment of workers' income. By bridging the digital divide between people and countries with access to technology, eLearning has a societal influence. It also reduces the gap in access to education and in achievement by girls and other underserved communities. It also enables student motivation to learn English since students who are proficient in English language cope better with global challenges (Olson, Codde and Tarkleson, 2011; Widyanti and Park, 2020).

2.6.5 eLearning in developed and developing countries

The available literature emphasises that the rise of eLearning activities is primarily occurring in nations like Germany, the United Kingdom, and the United States, which have developed economies and strong institutional and ICT infrastructure. However, in light of these changes, it is widely recognised fact that the need for improved development and usage of eLearning is even

higher in developing nations, which are grappling with the issues of equipping their human capital with the skills required in today's knowledge society (Gyambrah, 2007).

The main competitive advantage of nations in the knowledge economy is not their physical assets (land, natural resources, or even oil), but the quality and competence of their people (Rajpal *et al.*, 2008). Certainly, the use of Information and Communication Technologies (ICTs) for education dissemination is thought to have the most potential for governments seeking to meet rising demand for education while dealing with a growing teacher shortage (UNESCO 2006). The advantages of eLearning are:

- flexibility;
- less expensive than on-campus presence;
- the ability to accommodate an ever-increasing number of students;
- readiness of re-usable content;
- greater opportunities for human advancement;
- expanded educational opportunities;
- increase the efficacy of learning and teaching through the use of technology;
- efficiency e-Learning management;
- and research quality, among others (Kwofie & Henten, 2011; Kibuku, Ochieng and Wausi, 2020).

Apart from the above advantages of eLearning, it is obvious that many higher education institutions, in developing countries with limited resources and technical expertise, have failed to properly implement eLearning. Among others, the challenges to implement eLearning in developing countries are:

- lack of adequate eLearning policies and poor strategy;

- insufficient infrastructure for information and communication technology (ICT);
- the ever-changing technological landscape;
- eLearning users' lack of technical and pedagogical skills;
- lack of an eLearning theory that can guide the eLearning practice;
- budgetary constraints and sustainability issues;
- resistance to change; and
- quality issues (Qureshi *et al.*, 2012 & Kibuku et al, 2020)

2.6.6 Effectiveness of Learning and eLearning

Effective eLearning practice can be drawn from effective learning practice in that it should involve learners in the learning process, support independent learning skills, increase learners' skills and knowledge, and motivate them to continue learning (Davies, 2004).

Fruitful effective learning, however, is a multifaceted and inventive process which involves detecting objectives, identifying the needs of the learners, picking the most appropriate approach, and then striking an appropriate balance between eLearning and other modes of delivery when working within a technology-rich context (one in which practitioners can choose between eLearning and traditional options). Various topic areas, different types of learners, or different values about what is important in the learning encounter may benefit from one or a combination of learning theories. The learning strategy chosen is likely to be based on the practitioner's understanding of learning theory and practice. It can be influenced by the nature of the learning outcomes, the practitioner's awareness of the learners' inclinations, or the nature of the learning environment. Although a practitioner's pedagogical approach may not be expressed or named, it will have an impact on the design process.

2.6.7 eLearning Success Factors

Six aspects of success criteria are mentioned in the literature on information systems success: system quality (excellence), information quality, service quality, use, user happiness, and net benefit. These are identified and included in a comprehensive success model (Lee-Post, 2009)

adapted from DeLone and McLean's information systems success model (DeLone and McLean, 2002).

eLearning success is enhanced following a further five steps: diagnosing hurdles to effective eLearning endeavours; action planning to overcome the impediments; action-taking to implement the steps to overcome the obstructions; evaluating the changes that occur from the activities performed to determine their influence on eLearning success; and learning how to apply what you've learned to gain a better grasp of how to make eLearning work for you (Susman & Evered, 1978, cited in DeLone & McLean,2002).

The use of a prototype eLearning module is crucial in determining students' learning needs and how those needs may be satisfied in an eLearning environment, given the experimental and exploratory character of eLearning projects. Furthermore, concerns that arose during the prototype's development can be resolved ahead of time before resources are allocated to further building the online course's remaining modules.

Because an eLearning success model assumes instructors are experienced system developers and passionate eLearning adopters, it is useful for instructors to measure and evaluate eLearning success. Furthermore, the model's student-centered approach solely uses students' eLearning experiences as input for eLearning enhancements. As a result, both the instructors' and institutional views are added to the model, identifying institutional supports for instructors, particularly those who are skeptics of eLearning. Firstly, a solid technical infrastructure, such as campus-wide high-speed Internet access, and an institutional learning management system, such as WebCT or Blackboard, are two key institutional supports. Second, continuous teacher workshops should be organized to enable for eLearning best practices training and exchange. Third, eLearning development assistance in the form of technical and pedagogical aids should be provided to make eLearning adoption easier for instructors. Fourth, technical assistance should be available to address any problems that may develop during the delivery and access to eLearning. Fifth, financial incentives like as grants, awards, and other types of recognition should be used to promote eLearning.

The extended model also calls for an assessment of eLearning institutional outcomes, so that the effects of eLearning may be measured at the institutional level. Cost savings, more enrolment, higher rankings, and enhanced endowment are some examples of specific institutional outcome

measurements. This expanded approach offers a more holistic picture of eLearning success, with roles for students, educators, and institutions.

2.6.8 Learning theories and eLearning

The three common learning theories: Cognitivism, Behaviourism, and Constructivism can contribute for the development of online courses in different ways (Alzaghoul, 2012). Constructivist approaches teach real-life and personal applications, as well as contextual learning. Behaviourist approaches teach facts (what); cognitivist approaches teach principles and processes (how); Gunawardhana and others, on the other hand, argue that the Constructivist Learning Theory, which focuses on knowledge production based on prior experience, is a good fit for eLearning since it ensures learning for learners (Gunawardhana, 2020). However, some researchers argue that the differences between traditional learning and eLearning are sufficiently significant to warrant the beginnings of a novel theory of eLearning itself (Andrews & Richard, 2011)

Furthermore, from the pedagogical point of view, Constructivists emphasize the importance of the learner in educational processes, arguing that when technology is used effectively, it improves the quality of learning experiences. They also believe that technology allows students to actively participate in the development of knowledge rather than passively receiving it. However, eLearning without acknowledging the paradigm shift and providing the necessary technological infrastructure and efficient support service poses a number of issues, including lower educational quality and problems with providing effective services by trained instructors and tutors. This frequently results in high dropout rates (Naturwissenschaften & Beyene, 2010)

2.7 Chapter Conclusion

This chapter answers the research question on the existing education systems and how are they aligned to eLearning. To this end, key terms like education, education system, educational theories and eLearning are well defined. Furthermore, the current status of the education system and eLearning in the world are also analysed.

The chapter also discusses the education systems of developing countries that have varied structures and languages of instruction. Irrespective of that, they share some common challenges regarding their learning environment and instructional methods used. These are, among others, an inadequate number of teachers, inadequate resources, challenges of equity, teacher top-down

lessons (traditional mode of teaching), large class-sizes, untrained teachers, lack of teacher and students' motivation, and poor English language skills are some.

The chapter also indicates that the dominant learning theories behind the education systems of these developing countries are Behaviourism and Cognitivism since their main emphasis is on providing knowledge to the learner; it is assumed that the teacher is the main provider of knowledge and because the learner is considered as an information processor (similar to a computer), memory, motivation, reasoning, and reflection all play a role in learning (cognitivists). The Constructivist Learning Theory that emphasises active, participant-based learning is rarely practised in the instructional strategy of developing countries since the above-mentioned problems do not allow Constructivism to be implemented unless and otherwise it is facilitated by technology. This chapter, therefore, also argues for a well-designed, technology-assisted education to drive Constructivism.

This chapter also states the current status of education system and eLearning in developed countries. There are challenges that exist though they are radically minimised challenges compared to the developing nations such as, among others, a lack of equity in education access among the disadvantaged and advantaged groups of society, and some low achievements in the international arena. In countries like Germany with the challenges of large class size and teachers resistant to technology assisted education (by the older generation) are seen. In Finland, every challenge of the educational system is under control and it is believed that the system is the best globally.

The problems in the developing countries such as shortage of teachers, untrained teachers, poor English language and inadequate resources are no less a problem for the developed countries. All three theories; Behaviourism, Cognitivism and Constructivism are in use to design instructional strategies. In the case of developed countries, the pattern is shifting more from the use of Behaviourism and Cognitivism to Constructivism, that is, towards technology-assisted education.

It is also stated in this chapter that the rise of the knowledge economy, as well as the resulting demand for skills, has required the growth of higher education through eLearning. Various definitions of eLearning available in the literature are also discussed in this chapter. The current status of eLearning is the result of 40 years of technology evolution.

In this chapter, it is also argued that eLearning has positive impact on education, for example, by enhancing students' achievement. It also has social impact by reducing the digital divide among

the community and by providing equal access to education which has a positive effect on the economy. Apart from this, the growth of eLearning activities largely occurs in countries with mature economies rather than immature economies of developing countries.

The fact that effective practice of eLearning is a result of effective learning is also discussed in this chapter in that an eLearning success model incorporates dimensions like system quality, information quality, service quality, use, user satisfaction, and net benefit. Last but not least is the point raised that the three most common learning theories of Behaviourism, Cognitivism and Constructivism can also contribute to the development of online courses in different ways.

All the above, therefore, achieves the research objective; namely to ***Investigate education systems and their alignment to eLearning***.

An understanding of all the basic issues of education system and eLearning is very crucial for a further investigation of eLearning frameworks/models and their characteristics. This will be discussed in the next chapter.

3 CHAPTER THREE: eLEARNING FRAMEWORKS AND MODELS

3.1 Introduction

The widespread adoption of eLearning particularly in higher education institutions continues despite many challenges hampering the adoption process. Poor strategies, lack of infrastructure and poor pedagogic considerations can be attributed to the lack of a proper maturity assessment before implementing an eLearning programme. Despite many challenges hampering adoption the significant number of eLearning frameworks published by various authors in the literature serves as another challenge for learning institutions.

This study is considered it important to explore, analyse, synthesise and make comparative studies on existing eLearning frameworks and models. It is hoped that this would ultimately lead to investigating the possibility of a generic formalism aimed at representing all eLearning frameworks in the literature. Such a generic formalism could be used to characterise eLearning frameworks, for institutions to initiate adoption through generalisation instead of exploring many models and frameworks beforehand.

The main objective of this chapter, therefore, is to discover and study various eLearning frameworks and models available in the literature. This will be achieved by answering the research question: **What are the eLearning frameworks and models available in the literature and their respective characteristics?**

Ultimately, this process forms the basis for the conceptualization of a generic eLearning framework to be covered in the next chapter.

An eLearning framework provides a canvas for consideration of every aspect in the design process of an eLearning solution. eLearning models highlight how technology supports learning at the level of pedagogical principles as well as the level of detailed practice in putting those ideas into practice through the use of technology (Mayes & De Freitas, 2004). It is thus perceived that an eLearning model is more systemic, architectural and technology-centric while an eLearning framework is a structural set of interrelated constructs that form the basis for the development of a model. eLearning models and frameworks are consequently interrelated in the sense that every model in principle should stem from an underlying framework. The focus of this work, therefore, is mostly on eLearning frameworks for building eLearning models.

In this chapter, eLearning frameworks and models are explored for the purpose of enriching the knowledge base to achieve the main objective of the research, which is that of building an effective taxonomy of eLearning frameworks.

The sections of this chapter are organised as follows: in section 3.2 the literature on eLearning frameworks is explored and discussed by focussing on their characteristics, advantages and limitations. Section 3.3 is a similar analysis focusing eLearning models. A cross comparison in term of correlation of a selected few, between frameworks and models is discussed in section 3.4 where similarities and differences are highlighted. In section 3.5, a preliminary classification of eLearning frameworks and models is provided from which a complete taxonomy of a framework perspective is covered in Chapter 5. The conclusion to this chapter is presented in section 3.6.

3.2 eLearning Frameworks

A framework is an extensive outline, blueprint, or skeleton of interconnected objects that supports a specific approach to a certain goal and serves as a guide that can be changed by adding or removing pieces (Business Dictionary, 2016). A guide to plan, build, deploy, manage, and evaluate eLearning implementation is also known as an eLearning framework (Khan, 2005). Some of the eLearning frameworks practised in the current circumstances are discussed below.

3.2.1 Khan's Framework

According to Khan in (Khan,2005), eLearning replaces the former closed system of teaching and learning with an open system that allows students to choose when and where they wish to learn. It is very significant to move out of the closed system paradigm to create effective environments that cater for the various needs of learners. To assist such a paradigm shift, and in response to a variety of concerns, the eight-dimensional eLearning framework known as the Khan framework is proposed, as it follows Rutgers University Libraries in USA. The purpose of this framework is to give assistance on what should be done during the steps of the eLearning design process.

Institutional, pedagogical, technological, interface design, evaluation, management, resource support, and ethical issues are the eight dimensions of the Khan Framework (Suhail & Mugisa,

2007). Each dimension has an important role for effective implementation of eLearning and they are discussed in the section below Figure 3-1.

The dimensions of Khan's Framework encompasses the following components:

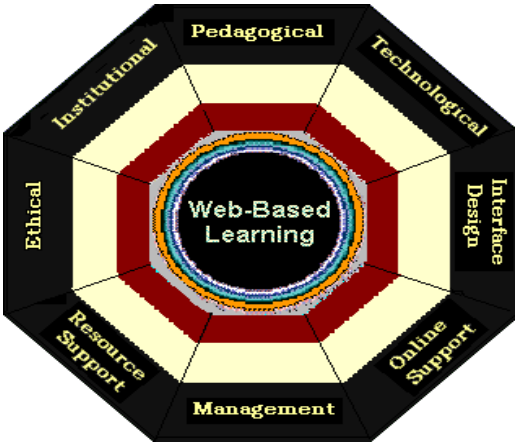

Figure 3-1: Khan's eLearning Framework.

- ***Institutional***: This component encompasses academic, administrative and student affairs as subcomponents. The administrative component deals with registration/application facility, payment facility, financial issues and information technology services (infrastructure). The academic aspect incorporates issues such as faculty and staff support (training), instructional matters (course quality, advising, work load) and computing service (software management). For student affairs, it involves orientation, bookstore, library, financial aid and counselling matters are discussed.
- ***Technological:*** This component deals with factors such as infrastructure planning, the hardware and software requirement. Infrastructure planning includes sub-aspects such as technical assistance planning, budgeting for hardware, software, and the internet. Under this dimension, all of the required hardware and software for the implementation of eLearning are also taken care of.
- ***Pedagogical***: This component includes the sub-dimension such as goals/objective of the course, content of the course, design approach, organisation of the course, methods and strategies, medium of eLearning environment and human resource. Under each sub dimension there are detailed factors such as clear learning outcome, accurate content, and

appropriate delivery method, content relevant graphics in the method, sense of continuity in courses, mixture of media for clear content.

- ***Resource Support***: This component incorporates sub-dimensions such as the online and offline resources support to facilitate usage of eLearning. Original documents, public domain books, summaries of or conversations about books in print, reference works (such as foreign-language dictionaries), research papers, novel concepts, notices of both face-to-face and online conferences, job information, and so on are all covered in these resources.
- ***Evaluation***: This is a dimension that deals with evaluation of learners' performance, Instructions and programs.
- ***Interface Design***: This is a dimension that deals with overall appearance and easy to use feature of eLearning programs. It is a way of making the web pages look good and have appropriate links on it.
- ***Management***: This dimension has two subcomponents: maintaining the learning environment and disseminating knowledge. Giving permission to use copyrighted information and materials can be one part of this dimension.
- ***Ethical considerations***: This is the last dimension and deals with issues of social and cultural diversity of eLearning users, Copyright and plagiarism issues are also embraced in this dimension.

Khan's Framework enables institutions to identify key issues that need consideration in the process of adopting eLearning. For example, an institution could evaluate the eLearning system to be adopted, whether it incorporates technological dimension of good maturity or not. The maturity level of each dimension should be checked for effective implementation of eLearning.

3.2.2 Orbital eLearning framework

The framework was developed in the context of Iraq and it is a modified form of the Khan Framework (Elameer & Idrus, 2012). It encompasses most of the eLearning issues, and gives emphasis to topics that were not previously addressed in previous frameworks, such as stability, sustainability, modularity, and standard learning ability. It has the potential to be a shining example of how technology and academia can collaborate. The overall dimensions that this framework covers are pedagogical, institutional, interface design, resource support, technological, ethical, content control, management, standardisation and stability, sustainability, modularity. According to Elameer & Idrus (2012) education and learning environments, models and frameworks will

continue to accommodate the constant changes in the learning environment. Stability, modularity and other new features of the orbital framework are necessary to accommodate the learning environment's predicted continual changes. According to the developers of the orbital e-education framework, for a stable electronic-based educational setting, scalability and modularity features of this framework are considered important. The modularity feature of the orbital e-education framework is helpful to integrate new functional components to the system that can work as part of the overall learning environment. The standardization feature on the other hand is capable of technical and semantic interchange between eLearning content and infrastructure. The stability feature of the framework is useful to achieve stability of the organisational standard, not to be influenced by the changing whims of society. Sustainable feature of the framework is there to meet current and future requirement.

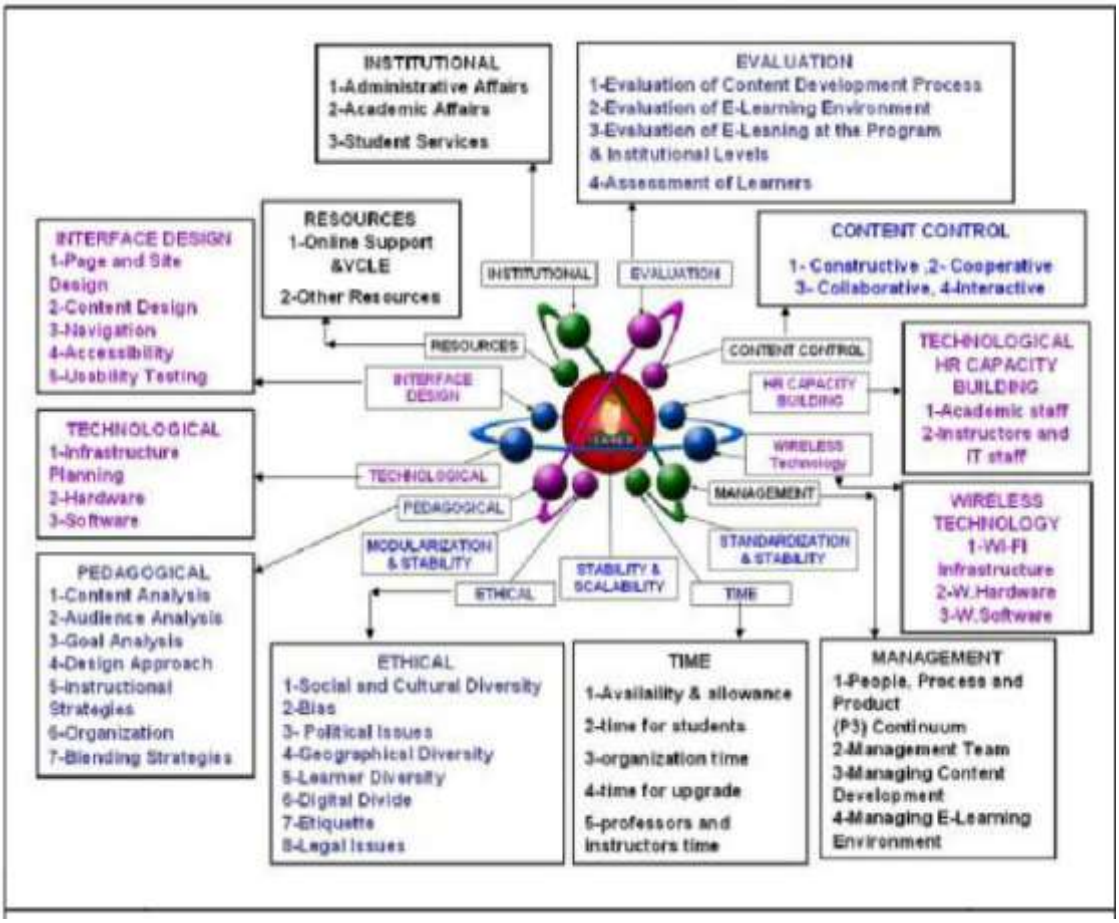

Figure 3-2: The Complete Orbit eEducation Framework (Elameer & Idrus,2012)

Generally speaking, this framework has three main domains: technological, organisational and educational. The technology domain incorporates interface design, technological and human

resource (HR) capacity building, wireless technology, stability, and scalability. The organisational domain contains institutional, management, time, resource, standardization, and stability. The educational domain also contains pedagogical, evaluation, ethical, content control, modularization, and stability.

An institution that decides to adopt this framework should see the maturity of the institution regarding the above-mentioned domains. For example, the interface that is going to be designed for the eLearning system of the institution should be easily usable, attractive, have desired content, and be easily navigable. The technology component of this eLearning framework should also be stable in all conditions/situations; it should fit all changing needs/environments. All these and the remaining domains of the orbital framework need attention in the process of adopting eLearning.

3.2.3 Comprehensive Blended eLearning Framework

A modified form of Khan's Blended Learning Framework that examines issues to address limits such as a lack of resources and poor infrastructure, such as insufficient bandwidth. The Comprehensive Blended Learning framework has the following dimensions: Bandwidth, Cultural, Institutional, Infrastructure, Content Development and e-learning Tools, Management and Student Support, Communication, Access and Financial Analysis. All of the dimensions are interconnected and arranged in a logical way.

The first step of the framework is to handle institutional matters and set up the necessary infrastructure. The second step is the issue of low bandwidth, cultural diversity of eLearning users, and other constraints will be addressed. Thirdly, content development and eLearning tools as well as management of blended learning program and Student support dimensions ought to be considered. Next, the developed courses will be mounted online and communicated. This can be accessed by students who are both within and outside the university. The last dimension of the framework is about the financial analysis or return on investment of the eLearning program (Suhail & Mugisa, 2007) as shown below in Fig. 3-3.

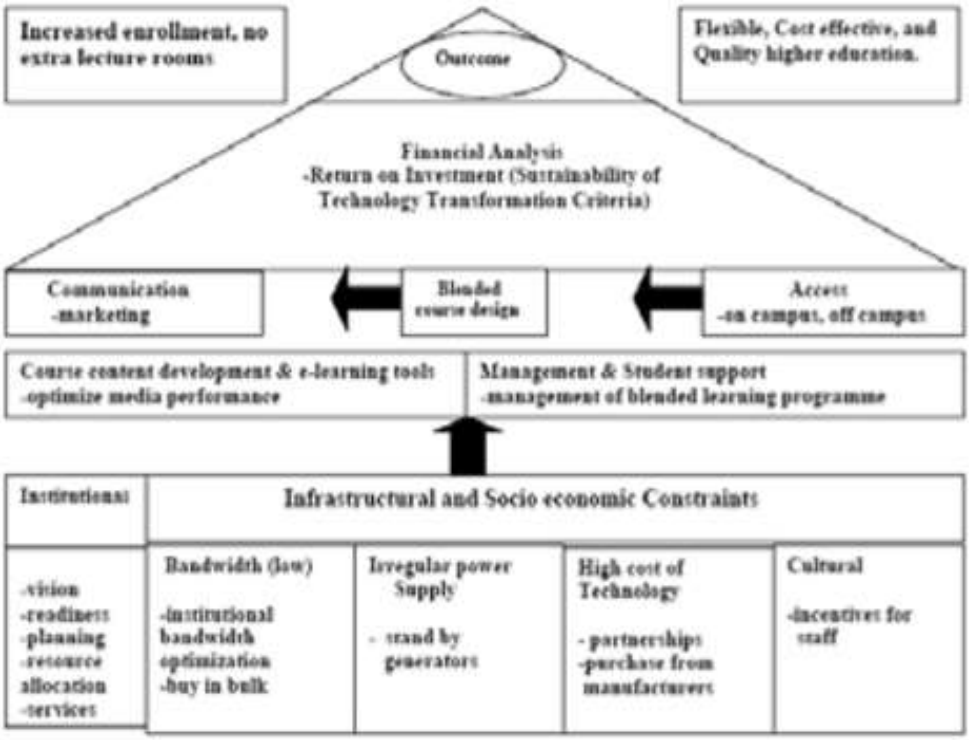

Figure 3-3: Comprehensive blended eLearning Framework (Suhail &Mugisa, 2007).

3.2.4 Blended multimedia-based E-Learning framework

Developed at the University of Zimbabwe by Zanamwe, (2010) the above modified form of Khan's Framework claims to improve the framework by stressing the cultural dimension. Here, culture is seen as a broad and crucial component that should be considered separately from ethics to provide effective teaching and learning. Therefore, it is assumed that when the cultural diversity of eLearning users is taken into account, teaching and learning will be improved and effective. This framework in general has the following components:

- Interface design;
- institutional resource support - technical, pedagogical, management, cultural (economical, language, political, social, and religious) evaluation; and
- ethical (equal opportunity).

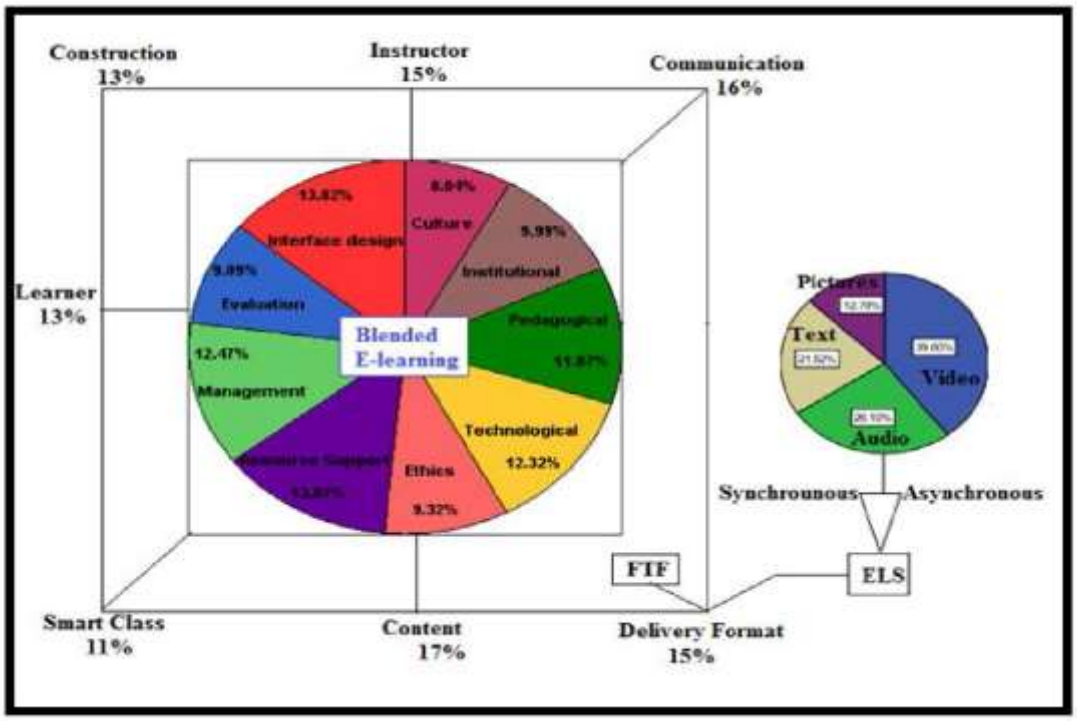

Figure 3-4: A blended multimedia-based eLearning Applications Framework (Zanamwe, N. 2010)

In designing a web-based learning environment, the diversity of culture and learning styles should be recognised to enhance diversity of the learners' way of learning. This is because, beyond the actual words spoken, there are major cross-cultural variations in interaction and communication.

3.2.5 Conceptual culture-oriented eLearning system development framework

The above is a framework developed in South Africa in 2015. It consists of components such as culture factor (moderate-informs), community factor (shapes), administrative factor; namely, student, learning style, content factor, activity/exercise factor and teacher as a central component (Joshua *et al.*, 2015). As the name indicates, this framework focuses on culture component since it is believed that every other component of eLearning (be it the learner as well as the learning environment) is affected directly or indirectly by the culture factor. Generally, as indicated in Figure 3-5 below, the cultural factor, in the form of static, dynamic, individual and collective culture influences other factors in the learning environment.

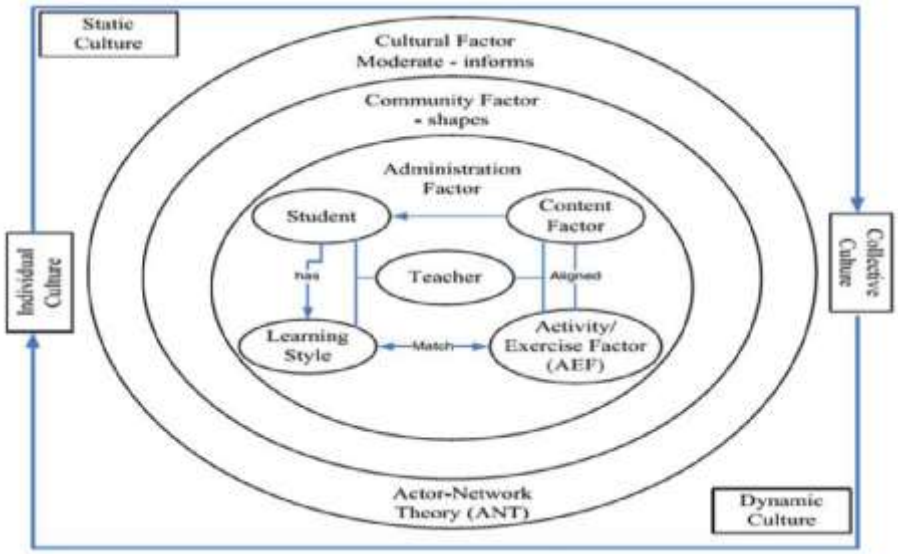

Figure 3-5: Conceptual culture-oriented e-LSD framework (Joshua et al, 2015)

Individual cultures are characterised by desires, views, inclinations, and misconceptions of individuals, while collective cultures are defined by their ethical identity, social values, and norms, as well as their local, regional, and geographical locations.

This framework emphasises that learners' learning styles and decisions on whether or not to use eLearning tools/systems are influenced by community, either directly or indirectly. The main factors that put up this framework are discussed below:

- **Cultural factors** co-occur with the community component, which facilitates successful communication, collaboration in the transmission and acquisition of knowledge, and collaboration with classmates in group discussion forums, chat rooms, news, announcements, wikis, bulletins, and other venues.
- **Administrative factor** deals with all the administrative tasks in the learning process that incorporates student support, formulation of e-course policy, set-up registration facility and so on. The following are sub-dimensions of this factor.
- **Student factor a**s a user of the e-learning systems that can be influenced by community and cultural factor
- **Learning style** is a learner's preferred manner or system for comprehending knowledge in a learning setting

- **Content factor** is about learning materials used in the learning process. It influences the satisfaction of users.
- **Teachers** serve as a liaison between administrators and students, and they are responsible for content, learning, and activities. Teachers are the persons in charge of administering content factors in a culturally impacted learning environment.
- **Activity/exercise factor**. Learners can use this platform to download and upload assignments, learning materials, read and comment on announcements, and much more. This component puts all of the activities associated to online learning closer together, allowing teachers, students, and administrators to be updated on any ongoing actions on a regular basis.
- **ANT (actor network theory).** This exists within the cultural component circle in order to comprehend the core culture on the creation of e-learning systems, as well as how culture may be effectively managed and knowledge conveyed via technological media.

3.2.6 Framework for Adaptation of Online Learning

Faridha created the Framework for Online Learning Adaptation in 2005. It is based on Bates' in (Bates 1997) ACTIONS paradigm, which includes the following aspects: Cost (C), Access (A), Technologies (T), Interactivity (I), Organisation (O), Novelty (N), and Speed (S). Faridha categorize the issues with online learning into three categories: managerial, educational, and technological. (Suhail & Mugisa 2007).

- **Educational.** Curriculum creation, instructional design, and delivery are all covered by this component.
- **Managerial.** This component encompasses all organizational issues and restrictions related to the deployment of online learning.
- **Technological.** This component addresses concerns including system access, integration, usability, and adaptability.

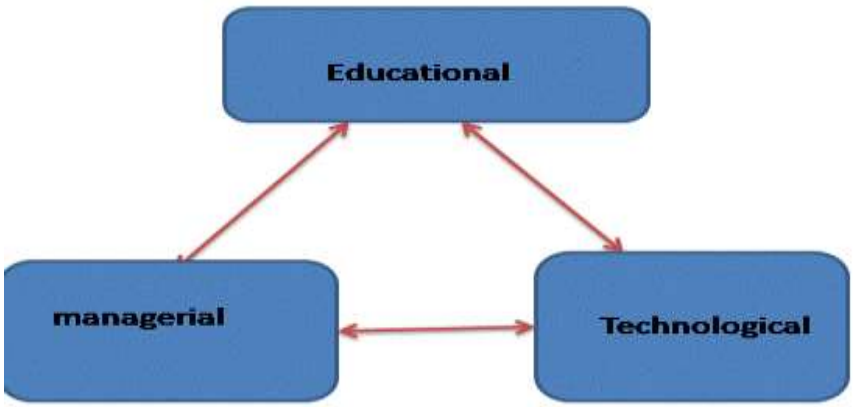

Figure 3-6: Framework for adaptation of online Learning

3.2.7 A framework for success

Jennifer (Jennifer 2005 cited in Suhail, 2007) established the Framework for Success, which consists of five elements: content, technology, administration and support, communication, and financial analysis. (Suhail &Mugisa, 2007) as shown in Figure 3-7 below.

Figure 3-7: A framework for eLearning success

3.2.8 California eLearning Framework

This framework is made up of content, technology, teaching and operational dimensions as follows:

- **Content**. Gaining content and quality of content are issues of this dimension.
- **Technology**. Selecting the most appropriate Learning management systems (LMSs) that can aid the method of teaching and learning is the main issue of this dimension.
- **Teaching.** This deals with issues of teacher recruitment, preparing standards for good online and blended learning instructions as well as support for the teachers.

Operation: This deals with issues of budget allocation for new instructional model and handling the challenges of student recruitment. This is shown in Figure 3-8 below.

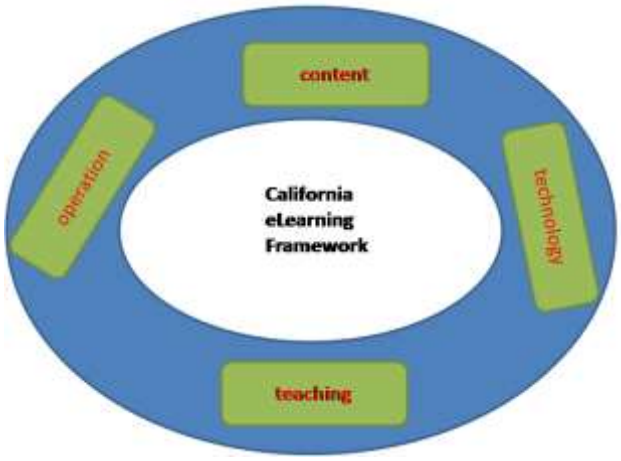

Figure 3-8: California eLearning Framework

3.2.9 Theory-based design framework

The theory-based design was developed by Dabbagh as a means of combining strategies, learning technologies, and pedagogy. According to Dabbagh (2005), an eLearning design is a collaborative result of three main components. The first is instructional strategy. This deals with pedagogical aspects of delivering a curriculum or content such as collaboration, role-playing, and exploration but materials development is not included in this category. The second component is about learning technologies such as asynchronous and synchronous tools, hypermedia, and multimedia tools. These are tools of support for delivering content. Thirdly, it concerns the general delivery methodology or the pedagogical models through which a curriculum is delivered such as open and flexible learning, distributed learning, among others (Madar & Willis, 2014).

Fig 3.9 represents the theory-based design framework and is adapted from (Dabbagh, 2005)

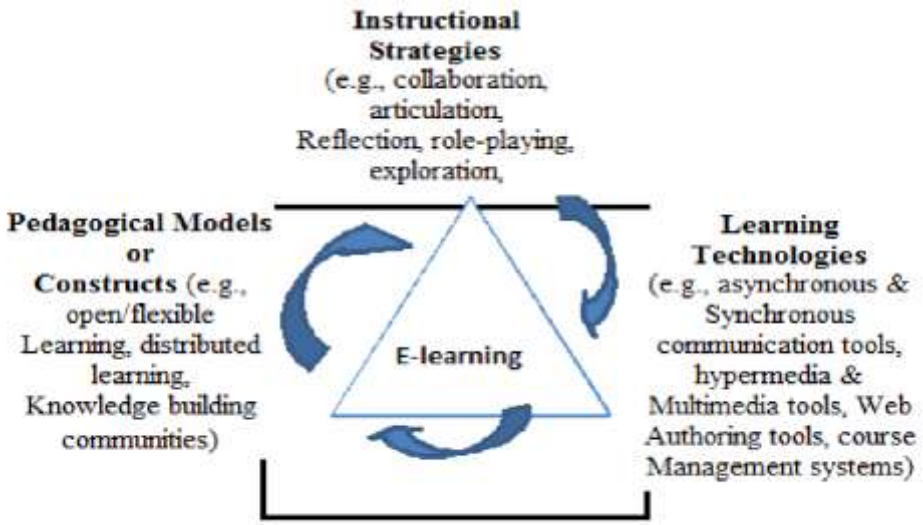

Figure 3-9: Theory-Based Design Framework for eLearning (Mohamed and Oso, 2014)

3.2.10 3C-Didactical Framework for the Design

Kerres and De Witt (2003 cited in Zanamwe, 2010) have claimed that a model should consist of three constituents; namely**,** (i) **a content** component that deals with a learner's learning material**;** (ii) a **communication** component that allows sharing of information between learners, as well as learners, and instructors ;and(iii) a **constructive** component that aids and leads learners as well as cooperative learning activities in actively completing learning tasks of varied degrees of difficulty (Zanamwe, 2010). This 3C-Didactical eLearning model is shown in Figure 3-10 below.

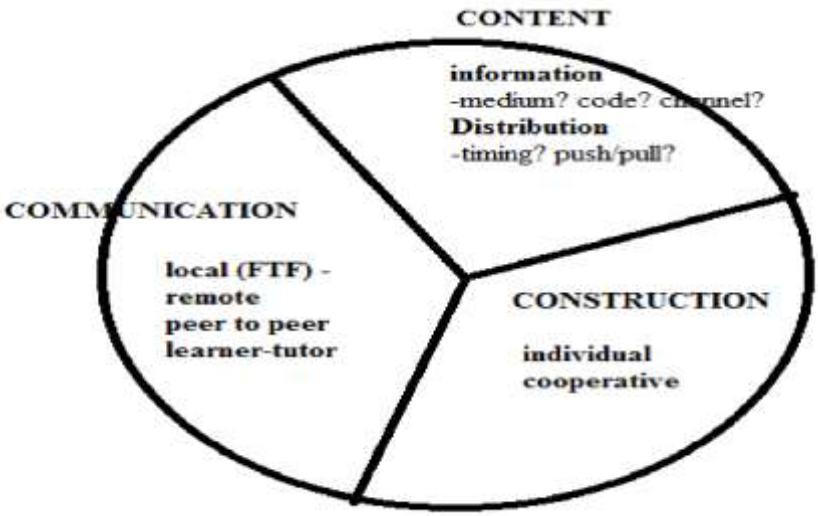

Figure 3-10:3C-Didactical eLearning model (Zanamwe, 2010)

3.2.11 Laurillard's Conversational Framework

Laurillard (1993, 2002, cited in Zanamwe 2010, p.31) has claimed that the teaching-learning process has four fundamental components, and diverse educational media can be analysed (and employed) in terms of these characteristics.

Laurillard's framework includes four important components:

- Concepts of teachers;
- constructed learning environment of teachers;
- concepts of students; and
- specific actions of students linked to learning activities.

The instructors' and learners' perspectives must be mutually accessible, and both parties must agree on learning objectives. The second sort of activity is an adaptation of the learners' behaviours to the teacher's built environment. For this activity, the instructor should adapt the objectives based on current conceptions, and learners must assimilate feedback and link it to their own beliefs. The interaction between the learner and the environment defined by the teacher is the third type of activity. In this activity, the instructor must 'adapt to the world,' that is, establish an atmosphere that is appropriate for the learner's learning task, as well as focus on task support and provide relevant feedback to the learner. The final sort of exercise involves both the teacher and the learner reflecting on the learner's performance. Here, the instructor must support the student in revising his conceptions and adapting the work to the learner's needs, and learners should reflect on all stages of the learning process, including original concepts, tasks, objectives, and feedback, among other things (Zanamwe, 2010). The diagram below is adapted from Zanamwe, 2010.

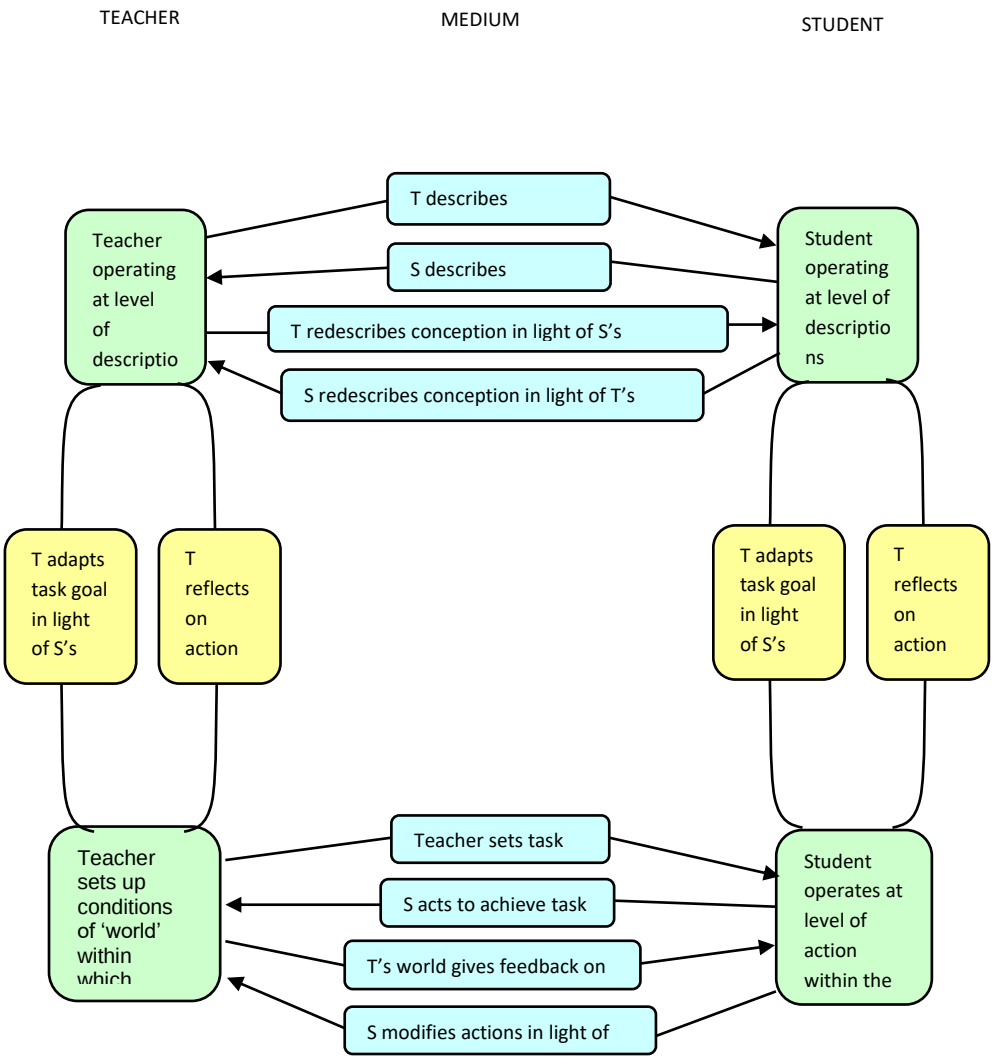

Figure 3-11: The Conversational Framework (Zanamwe, 2010)

3.3 eLearning Models

It is revealed in the literatures that a model is a series of mathematical equations that is used to describe a real-world entity or phenomenon. However, Frameworks are more concrete and easier to imagine than models. Models, on the other hand, are much more complex. A Model is a standard for imitation or comparison. It is a representation, usually in miniature, to depict the creation or appearance of something (dictionary.com 2021, model entry).

A software process model can be defined as a condensed sketch of a software process that shows one perspective of a process and may also include activities that are part of the software development process and deliverables, as well as the constraints that apply to the process and the roles of the people involved.

Models of eLearning highlight how technology is used to support learning in various ways. These can be characterized at two levels: educational principles and detailed practice in putting those ideas into effect (Mayes & De Freitas, 2004). The eLearning model is used to describe metrics that can be used to assess the effectiveness of information systems. Davis' Technology Acceptance model is based on the Theory of Reasoned Action (TRA) and Theory of Planned Behaviour, and was developed a few years ago. It is one of the most reliable models for explaining the elements that influence the acceptability of information technologies (Hagos, 2019).

The Conceptual model is separated from the design or implementation issues. Its goal is to communicate the meaning of terms and concepts used by domain experts to solve a problem, as well as to establish proper relationships between concepts. A conceptual model can be a useful tool for demonstrating business understanding and clarity. The model becomes a stable foundation for subsequent development of domain applications once the domain concepts have been modelled. Manual or automatic code generation methodologies can be used to map conceptual model ideas into physical design or implementation constructs. (Conceptual model 2015.Wikipedia).

The following 15 eLearning models are described in terms of the frameworks that underlie them and they consist of set of constructs useful for the development of the model.

3.3.1 The demand-driven learning model.

MacDonald et al (2001 cited in Suhail & Mugisa, 2007, p.308) created the demand-driven learning paradigm in Canada (2001). It is the result of a collaboration between academics and experts from the private and governmental sectors. The three learner demands are highlighted: high-quality material, delivery, and service.

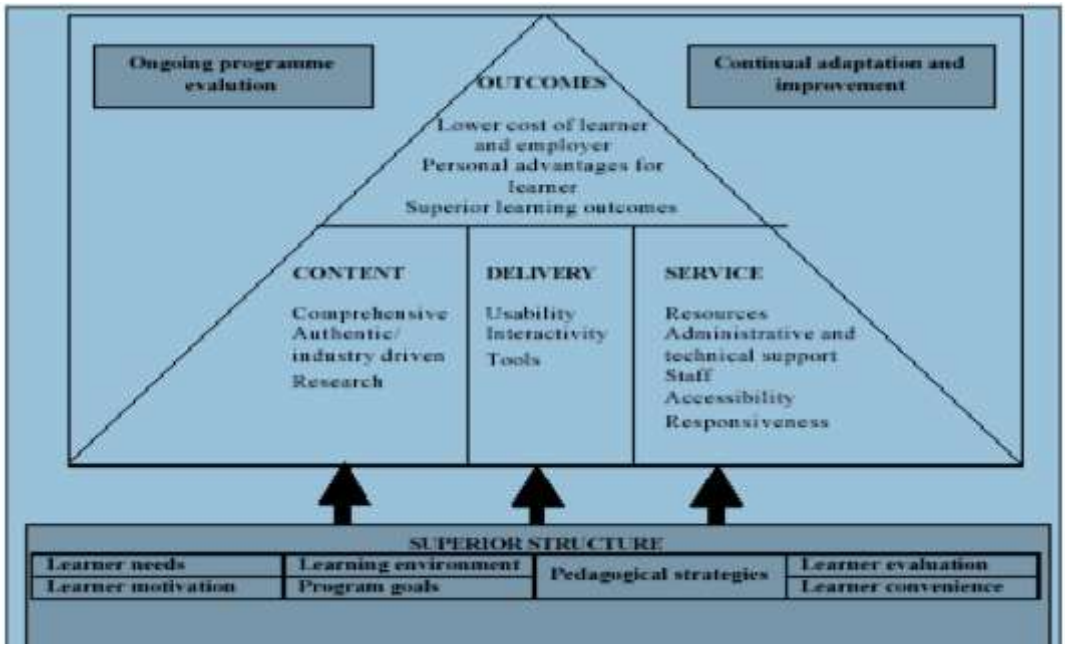

Figure 3-12:The demand-driven learning model (MacDonald et al 2001)

The above diagram adapted from (MacDonald et al 2001) shows that the learners' need or motivation (demand driven) as well as learning environment should be identified first. Based on this, pedagogical strategies will be proposed to develop quality content and select quality tools to deliver the content, as well as to evaluate learners. This model focuses on high-quality, well-researched content that will be delivered using interactive and accessible tools with the assistance of various technical and physical supports. It also underlines continuing program evaluation and frequent adaptation for improvement.

3.3.2 Funnel Model

The funnel model is concerned with the creation of materials based on the needs of learners, followed by the instructional design process. Firstly, the funnel model necessitates the development of teaching and learning materials as well as a distribution method. Secondly, technological design can be either synchronous or asynchronous since technology is only a tool to deliver content to learners. This model also considers the accessibility and availability of technology to ensure that it is compatible with the instructional design of the teaching materials. Finally, the funnel model includes administration, which encompasses governance and finance, since the long-term viability of any system is dependent on its management (Madar & Willis, 2014).

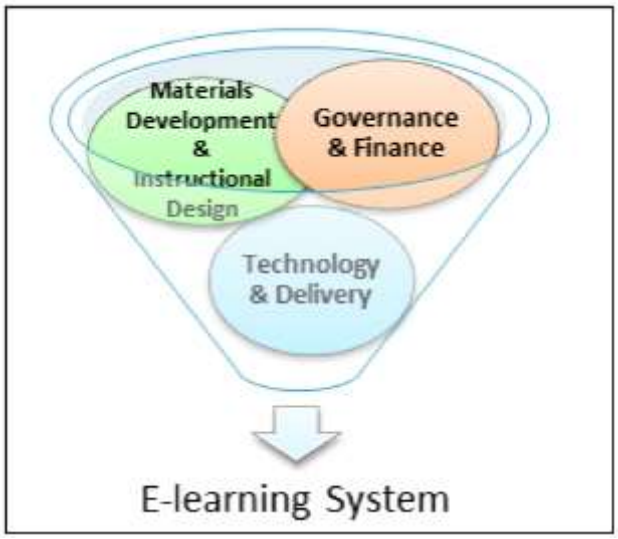

Figure 3-13: Funnel model (Madar and Willis, 2014)

In this Funnel model, teaching-learning material is developed based on the analysis of learners' need as well as pedagogical knowledge. Then, tools of delivery will be selected. All this will be done through finance and administrative support.

3.3.3 The Pedagogical model

Dabbagh (2005) also developed the Pedagogical model of eLearning, which focuses on content management and distribution. In this model, the student and the teacher are the two main actors that are given emphasis. This model is based on the user entity acquiring a package and customizing it to meet their academic needs (Madar & Willis, 2014).

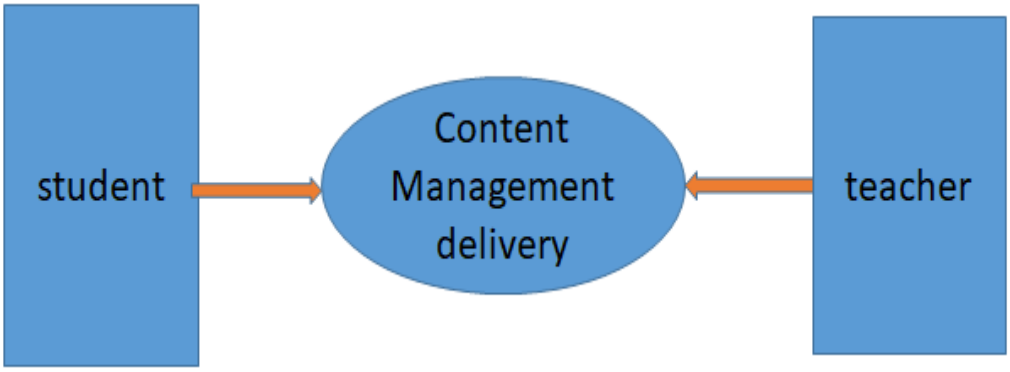

Figure 3-14: Pedagogical model (Dabbagh, 2005)

3.3.4 V-model of e-learning

The V-model is developed based on Gagne's nine steps of instruction. The first step of this model is 'Gain attention'. Then, activities such as telling the objective of the course and recall prior learning will come next. Giving the motivation, providing learning direction followed by evoking performance, and delivering feedback will be the steps that followed. Finally, assessing performance of learners, enhance retention and transfer to other contexts will be done (Al-Shalabi *et al.*, 2012). This model only focuses on how learning material is delivered to the learner. It gives attention to how the instructional method is designed in terms of having pedagogic knowledge.

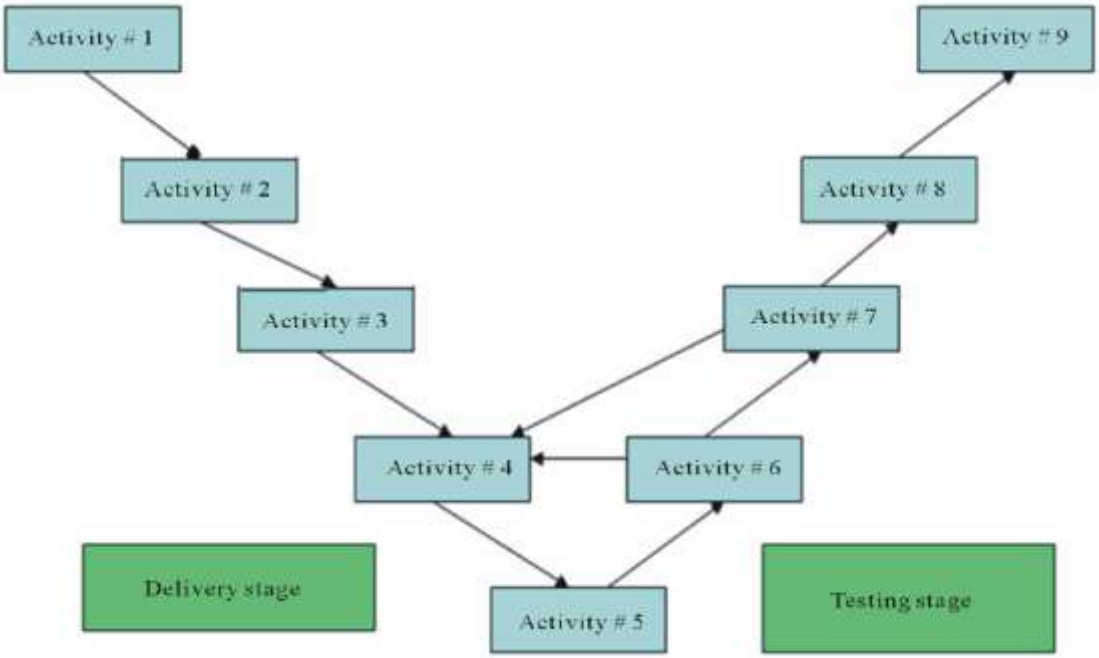

Figure 3-15: eLearning V-model (Al-Shalabi et al 2012).

3.3.5 Delivery Model for Blended eLearning

Al-Huwail et al, (2007 cited in Zanamwe, 2010) proposed a delivery method for blended eLearning. Learning management system (LMS), well-furnished classrooms with multimedia (smart classrooms), and network/internet are the bricks that build the teaching-learning environment of this model. The model depicts that student meet with instructor in smart classrooms. The instructor facilitates the learning process by using online material that students' access through the internet. Followed by the learning activities, the LMS also provide the instructor with performance report about the learning process (Zanamwe, 2010). This model focuses on the delivery method or technology of the teaching learning process; it does not focus on how the course

materials are developed and how dissemination of information is managed, though there is a LMS that may handle the data distribution method.

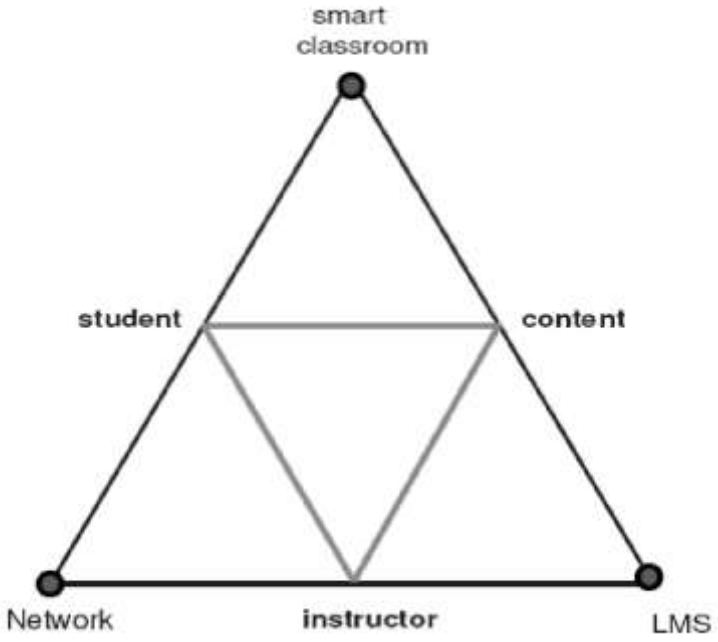

Figure 3-16: Delivery Environment Framework (Al-Huwail et al 2007)

3.3.6 Adjunct eLearning Model

The Adjunct eLearning model is a model that continues the old learning process while also allowing learners and teachers to communicate outside of school hours using computer communication media.

Discussions, broadcasting exercises, performing collaborative learning among learners, and conveying knowledge from the teacher to the learners via computer communication media are all possible with this architecture. The learner's engagement is often voluntary, but it is occasionally included into the curriculum, and the learner may gain credit for his or her efforts. It has been the most popular model in the world since the 1970s. (Rashty, 1998).

This model doesn't focus on pedagogy-based course development activity and other relevant steps in the implementation of eLearning. It only gives emphasis to communication media that can support the traditional mode of education through discussion, chat and transferring of information from the teacher to students and vice versa

The graphical representation of the model is shown in Figure 3-17 as follows:

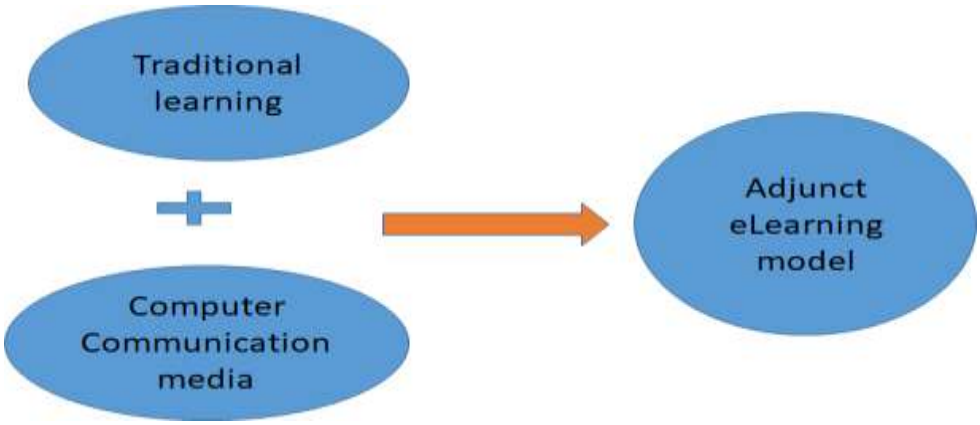

Figure 3-17: Adjunct eLearning model (Rashty's Delivery Model,1998)

3.3.7 Mixed eLearning model

A mixed eLearning model integrates online course delivery with traditional mode of delivery. In this approach, the usage of eLearning is an inherent aspect of the curriculum and the evaluation of students. Furthermore, the network is used for simulation and role-playing, as well as for students' reciprocal evaluation of each other's work. Here, the courses can also be delivered using the online and traditional mode of teaching-learning (Rashty, 1998). This model, therefore, focuses on the delivery mode not on the course development activity, the policy issue, copyright and so on. The graphical representation of the model is shown below.

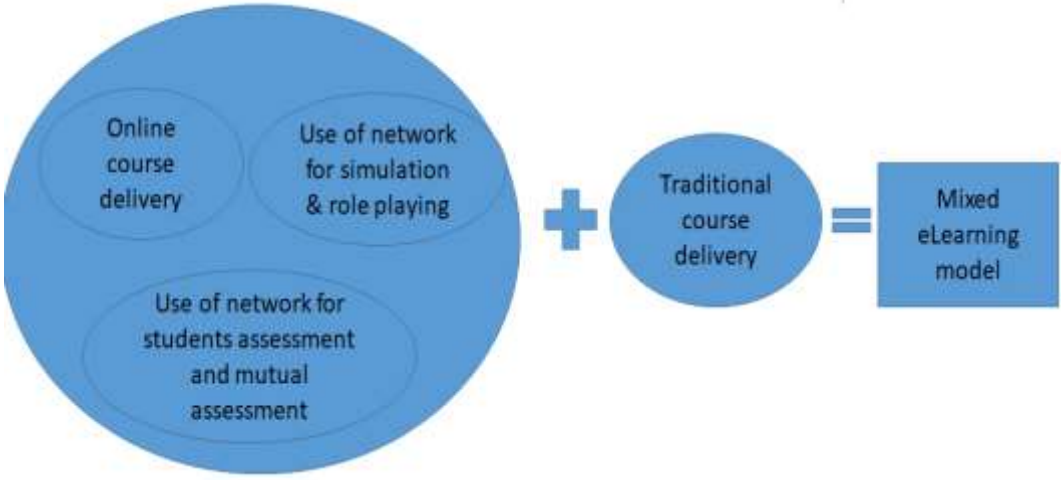

Figure 3-18: Mixed eLearning framework (Rashty's delivery model)

3.3.8 Online model

This model uses mainly online mode of course delivery, as opposed to the above two models, whereby a face-to-face (traditional) meeting is rare for course delivery.

Here, most of the interaction in the online model course is by the help of communications network and the computer. However, face-to-face sessions are required for presenting the course and learning how to use computer communications. Joint learning is a part of the teaching-learning process in the online model, as it is in the other models examined.

All of the learning interaction takes place online and all material sent online. Hyperlinked course materials, Streaming video, audio, text and images are examples of teaching learning interaction of this model. Online and collaborative learning are key features of this model (Rashty, 1998). The diagrammatical representation of the model is shown in Figure 3-19 below:

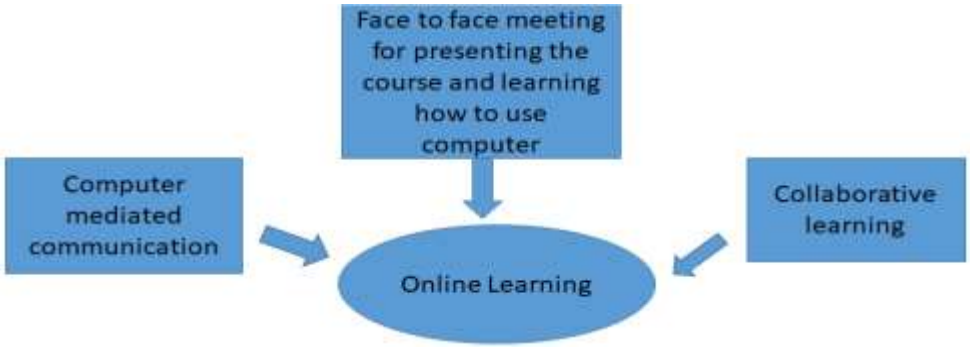

Figure 3-19: Online model

3.3.9 Synchronous – Live (Online) model

This model allows concurrent learning; all participants are online at one time and learn from each other. It is a scheduled and collaborative mode and works in an online real time and live environment. Audio and video conference, virtual classroom, online chat, live, webcasting, instant messaging, shared whiteboards are tools that are used by this model (Nejad, Nejad & Sadeghijoola, 2012). The graphical representation of the model is shown as follows:

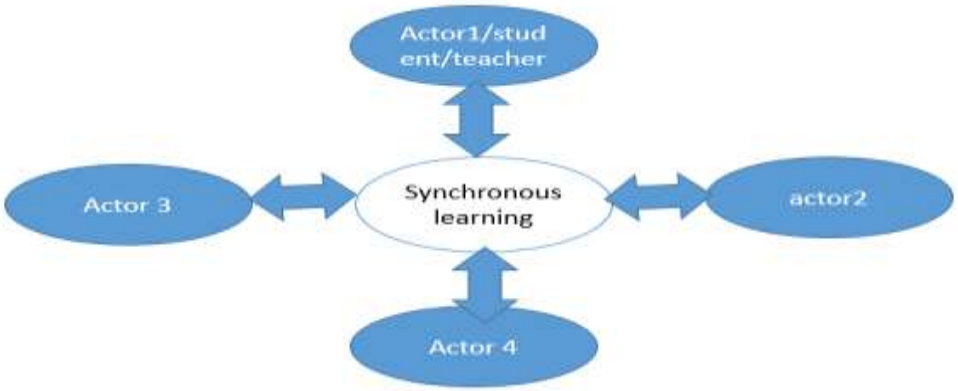

Figure 3-20: Synchronous live online model

3.3.10 Asynchronous self-paced (off-line) model

This model works in offline mode and allows flexible schedule for course delivery. It also facilitates self-paced learning (independent learning), but it is less collaborative. In this model, all participants are not expected to meet at one time. Email, discussion boards, web-based training, podcasting, computer aided systems, watching a video lesson, taking an online exam or posting questions to a message board, on-demand access, previously recorded or pre produced learning materials can be considered as techniques to implement this model (Nejad, Nejad & Sadeghijoola, 2012). The diagrammatical representation of this model is shown below.

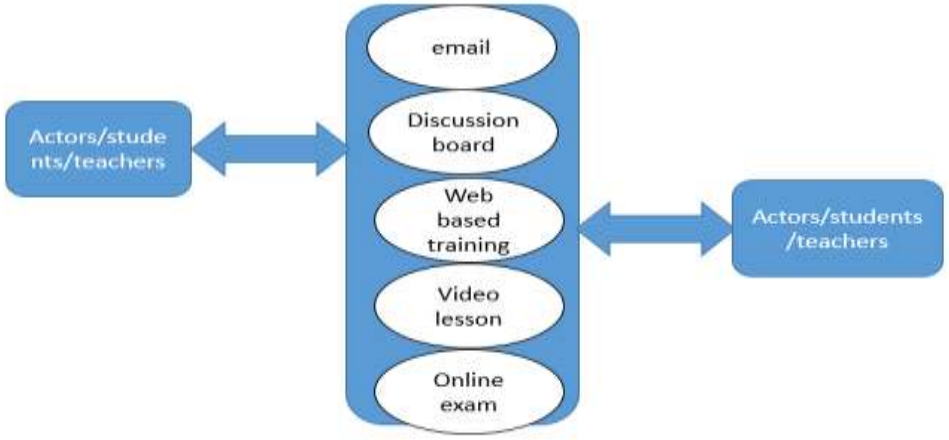

Figure 3-21: Asynchronous self-paced (Off-line) model Computer Base Training Model

This model enables an institute to provide more memory-based trainings, such as through CDs. Content software technologies can be used to create course content.

It is interactive and user friendly and focus on needs of the trainee and it has possibility of anytime access. This type of training model can have resourceful role for countries that don't have the needed infrastructure (Nejad, Nejad and Sadeghijoola, 2012). The diagrammatical representation of this model is shown below in Figure 3-22.

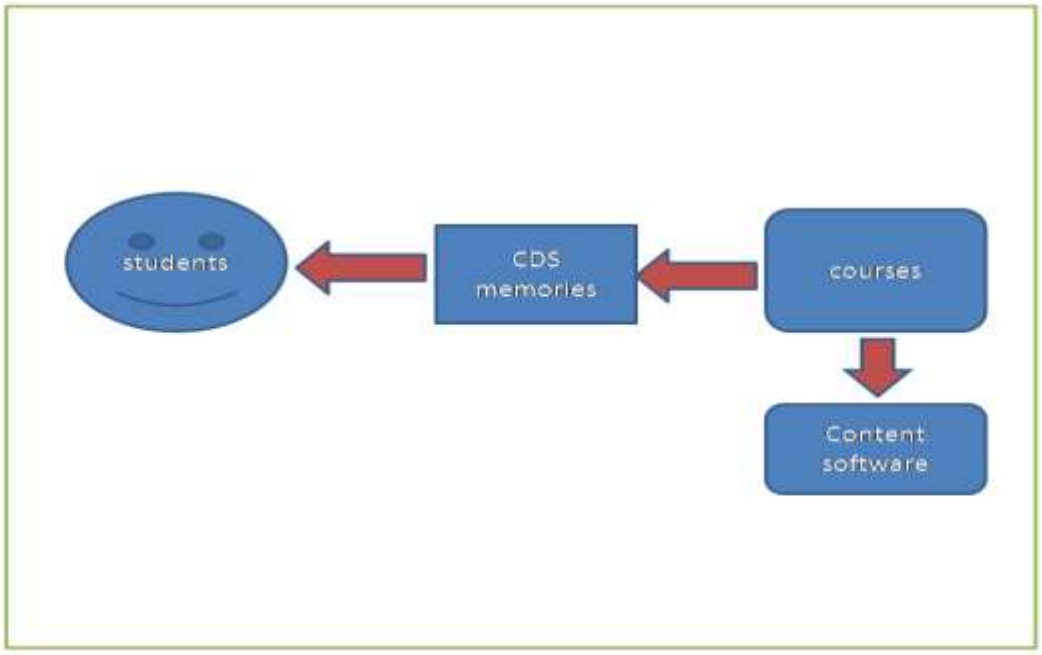

Figure 3-22: Computer-based training model

3.3.11 Internet-based training model

This model uses available network and web technologies to present course content. It necessitates a skilled workforce as well as the country's telecommunications network infrastructure in order to use the internet and create educational content (Nejad, Nejad & Sadeghijoola, 2012). The diagrammatical representation of this model is shown below.

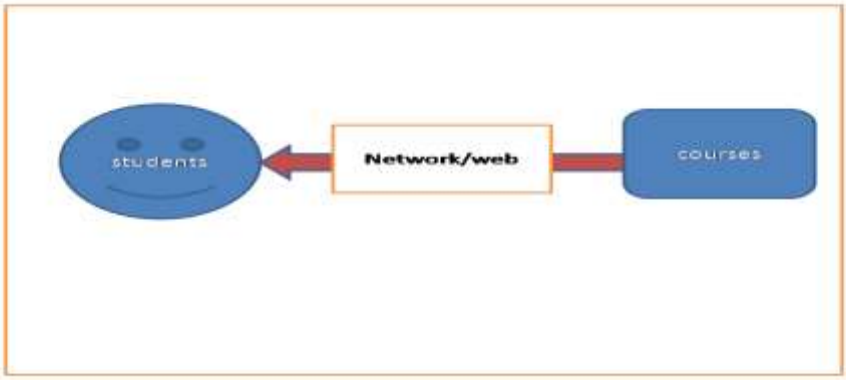

Figure 3-23: Internet-based training model

3.3.12 Web-Based Training Model

This is an eLearning model that facilitates any training through the web and local network. Content can be delivered through local networks and the web (Nejad, Nejad & Sadeghijoola, 2012). The diagrammatical representation of this model is shown below.

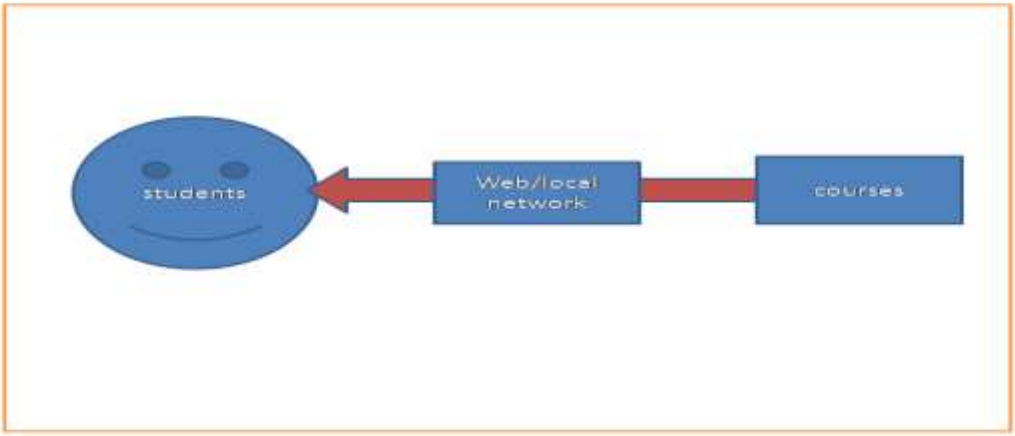

Figure 3-24:Web-based training model

3.3.13 Hexa-C eLearning model

The Hexa-C Meta model (HCMm) is a brief approach that incorporates principles from Contemporary Learning Theory into a framework that can be used to develop and evaluate e-learning systems such as online learning, educational apps, and WBL (web-based learning). It's called 'Hexa-C' because each of its six elements begins with the letter 'C.' (De Villiers, 2006). This model's foundation was developed around six pillars, with technology being passive to the

learning. In this model, technology is the hub, which is the medium but not the message; the tool for transferring message, but not the instructor (De Villiers, 2006). Cognitive learning is one of the six pillars of the Hexa-C Model that is nurtured through the understanding of human comprehension, knowledge gaining, and problem solving. Cognitivism encourages learners to develop critical thinking skills and to reflect on their own learning. The other cornerstone of the model is customisation, which advocates for the trend to personalise learning environments to better suit the needs of learners. The third pillar is constructivism which encourages participatory learning, constructive participation, and situated learning in the real world. The other pillar is collaborative learning, which entails teamwork, peer review, intellectual companionship, social negotiation, and accountability. Creativity is the fifth pillar that is fostered when creative and innovative strategies are employed. The last but not the least pillar is components which refers to an understanding of learning outcomes and how different environments better facilitate the production of various abilities, dispositions, and/or knowledge bases. The diagram below is adapted from De Villiers (2006). The diagrammatical representation of this model is shown below.

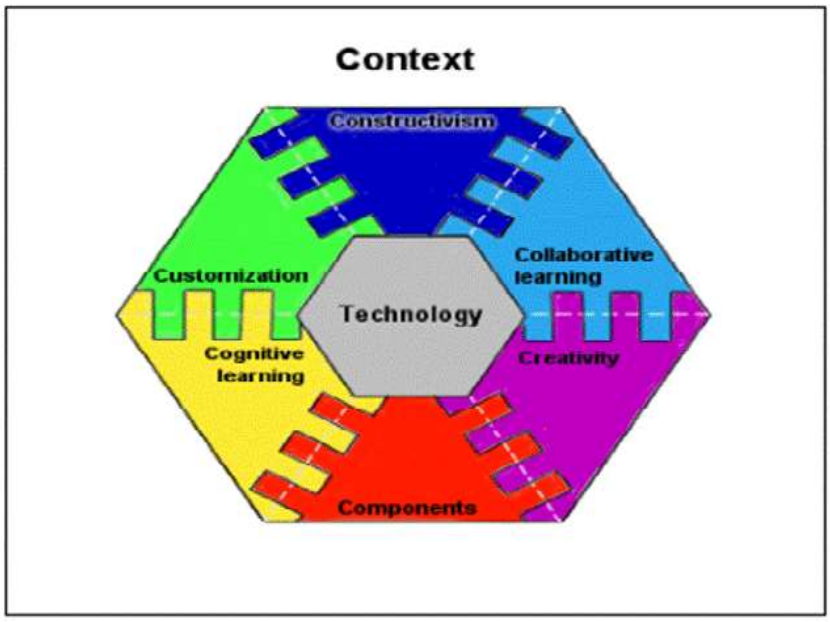

Figure 3-25: The framework of the Hexa-C meta model (De Villiers, 2005)

3.3.14 Five-stage model of teaching and learning online

This model can be used to define the classic activities in which tutors can participate with students at various stages of their learning process (Salmon, 2000). It is applicable in a text-based asynchronous environment. The first stage of this model is access and motivation. At this point

the tutors are expected to do welcoming and encouraging. The second stage of this model is online socialization. During this point, students send and receive messages, as well as familiarise and provide cultural bridges; and tutors perform icebreakers and introductions in accordance with this. The third stage is information exchange. Students may engage in activities such as carrying out activities, documenting results, and discussing findings. In line with this, the teacher may promote organised exercises, encourage dialogue, and support the use of learning materials. Knowledge construction is the fourth stage of this model. Here, students do conferencing, course-related discussions and critical thinking applied to subject material. At the same time, the tutor will do the facilitation. Development is the fifth stage, in which students do reflection on learning processes and use conferencing strategically. The tutor then supports and encourage this reflection. The above stages of this model work together to bring engagement in eLearning. The diagrammatical representation of this model is shown below.

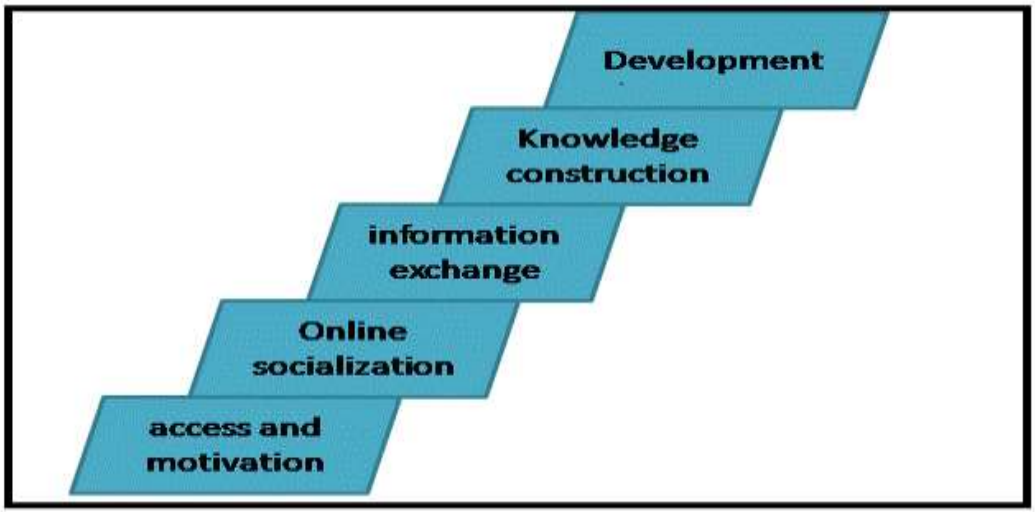

Figure 3-26: Five stage model of eLearning

3.4 Aligning eLearning Models to the eLearning Frameworks

Thus far, this study's investigation supports that an eLearning framework is more theoretical than an eLearning model. Therefore, eLearning models are more specific and near to implementation than eLearning frameworks. This researcher is also of the view that behind every model, there is a framework. In this section, a demonstration of this assertion is made by correlating some eLearning models with their corresponding eLearning frameworks.

3.4.1 Demand-drive model and Khan's framework

The demand-driven eLearning model has three main but specific components; namely, course, delivery, and service. These components can be directly aligned with some of the building blocks of Khan's eLearning Framework. The content component of the demand-driven model can be directly aligned with the pedagogical building block of Khan's Framework. The delivery component of the model can also be aligned with the technology building blocks of Khan's Framework and finally, the service component of the model can be aligned with the institution building blocks of the framework. Though the components of the demand-driven model are aligned with the building blocks of Khan's Framework, the maturity level of each of the components of the demand-driven model may not be up to the level each building block of Khan's model is expected to achieve.

3.4.2 Synchronous-live online model and Comprehensive Blended Learning Framework

Synchronous-live online model allows parallel learning; all participants are online at one time and learn from each other. Similar to the above model, the student, course, and delivery tool are components of this model. These components can also be aligned with the building blocks of Comprehensive Blended learning Framework. This latter framework has building blocks; namely, Infrastructure, Institutional, Bandwidth, Cultural, Content Development and e-learning Tools, Management and Student Support, Communication, Access and Financial Analysis. Thus, the course component of the model can be aligned with the content development and eLearning tools building blocks. Likewise, the delivery tool can be aligned with the eLearning tool, infrastructure, and bandwidth building blocks of the proposed framework. In addition, the student component can be aligned with the institutional building block of the framework. Apart from the above explanation, the components of the model can be considered as some elements of the building blocks of the proposed framework.

3.4.3 Asynchronous-Self Paced model and adaptation of online learning framework

The Asynchronous-Self Paced (offline) model works in disconnected mode and allows a flexible schedule for the course-delivery activity; however, there is no strong two-way communication among users of the system. The framework behind this may incorporate pedagogy, and technology, but the extent that the model uses technology and other building blocks may vary. This model is therefore aligned with online learning framework that has the building blocks of educational, managerial and technological. The component learning technologies can be aligned with the

technology building block of the suggested framework. The course and student component of the model can be aligned with educational and managerial building blocks of the framework

Based on the above, it can be concluded that models can easily be correlated to frameworks, demonstrating, therefore, that the two concepts are interrelated and more importantly, behind any model, there is a framework to support it.

3.5 Preliminary Classification of eLearning Frameworks and Models

According to Elameer & Idrus (2012), education and learning environments, as well as frameworks, will continue to evolve to accommodate the continuous changes in the learning environment. The proliferation of such frameworks as well as the lack of a scientific understanding of their characteristics and relationships can be seen as inhibiting factors towards selection and adoption of an appropriate eLearning framework.

This section provides a preliminary classification of eLearning frameworks based on a literature review and identification of some formal relationships between various eLearning frameworks. The ultimate purpose of this classification is to enable learning institutions to make informed decisions on the suitable eLearning solution to be adopted in their institution based on their core characteristics.

To this end, various classification schemes available in the literature are explored to investigate how to establish a formal relationship among them. Nejad, Nejad & Sadeghijoola (2012) provide a classification that contains two eLearning models; namely, synchronous and asynchronous. The Synchronous (live) Model supports online learning and participants are able to communicate through video conferencing and virtual classrooms. The Asynchronous (self-paced) Model is offline and participants are not connected simultaneously; material could be accessed via web-based interfaces with download facilities. Computer Based Training (CBT) is yet another eLearning model whereby, learning material are delivered through electronic supports such as DVDs, CDs, and USB drives.

Of course, such learning contents can be downloaded by the learner from a well-identified environment (often web-portal) with appropriate credentials for authentication. Depending on the kind of learning activity being undertaken, CBT may make use of the synchronous or asynchronous mode.

The other eLearning paradigm is internet-based training (IBT), in which the course information is offered via network and online technologies. The Web based training (WBT) model is also regarded as an eLearning model that deals with the delivery of content through the web. In various parts of the Middle East, the mode of adoption of eLearning varies from one learning institution to another. In fact, three main eLearning models are established in diverse parts of the region, namely: virtual, hybrid and traditional. The virtual model is that adopted by most online universities, whereby all communications between the learner and the teacher are mostly online through virtual classroom, chat room as well as on-demand resources (Mirza & Al-Abdulkareem, 2011).

The hybrid approach consists of a course management system for getting course materials and completing assignments, as well as physical buildings where students can register, take tests, and attend meetings. The traditional model is designed to support face-to-face course attendance as well as a learning management system that offers electronic material for complementing physical course attendance (assignments, tutorials, attendance, marks, communication, exams, and so on). Besides the synchronous and asynchronous models previously discussed, Rashty (1998) further discusses three models referred to as adjunct, mixed and online models as follows:

- The adjunct eLearning model enhances the old learning process by allowing learners and teachers to communicate outside of school hours. Computer communication media is used to facilitate discussions, to offer exercises, to implement collective learning and convey information from the teacher to the learners. The adjunct model has integrated e-mail into the traditional learning process. Furthermore, the internet is used to comprehend the utilization of network resources as well as the use of authentic and innovative sources in relation to the course material.
- In the mixed model, the use of eLearning is a basic part of the curriculum and of the student's assessment. It can use the network for the purpose of simulation and role playing, for mutual assessment of each other's work. It also caters for the possibility of presenting online courses' sections or parts thereof in addition to those presented in the traditional way.
- In the online model, the system is all networked and most of the interaction is done through the network. Face-to-face meetings for presenting the course, learning how to use computer

communications, as well as collaborative learning are part of the model. Various other eLearning models not mentioned in this section have been explored such as: electronic education systems; ecosystem model; e-education framework; the demand driven learning model as well as the open distance learning information system model (Maneschijn, 2005).

Similarly, different eLearning frameworks that have detailed dimensions are also discussed in the literature.

- The Khan eLearning framework is one with eight dimensions; namely, institutional, pedagogical, technological, interface design, evaluation, management, resource support, and ethical considerations (Suhail & Mugisa 2007). These dimensions enable the understanding of what should be done during implementation of eLearning. As opposed to eLearning frameworks or models that came in the earlier times, Khan Framework has brought new features or building blocks such as ethics, institution and evaluation which are very relevant for implementation of eLearning. These new features address equal access to Educational ethical issues and the provision of necessary training, among others.
- Orbital e-education framework is another eLearning framework and a modified form of the Khan Framework (Elameer& Idrus,2012). It has been developed in the context of Iraq. It covers all the issues of eLearning that are covered in Khan Framework and, in addition, it gives attention to areas like: stability, sustainability, modularity, and standard ability of learning. The feature stability, modularity and other new features are important to cater for the expected constant changes in the learning environment. Modularisation is also important to add new functional components to the eLearning system. Standardization also enables technical and semantic interoperability between eLearning content and infrastructure. Stability of the organisational standard must be achieved so as not to be influenced by the changing winds of society. The sustainable feature of e-education is used to meet the current and future requirement of the organisation.
- The Comprehensive Blended Learning Framework is also an eLearning framework that considers all issues in Khan's Framework and constraints like; scarcity of resources and inadequate infrastructure, including insufficient bandwidth. This framework has sequential dimensions that begins with handling institutional matters and end with access and financial analysis. In between, components like infrastructure, bandwidth, cultural, content

development and eLearning tools, management and student support, as well as communication are treated in sequential approach.

- The Blended multimedia-based eLearning framework is another eLearning framework that belongs to Khan's family and it upgrades the performance of khan's framework by giving emphasis to culture component. Here, culture is seen as a broad and crucial component that should be seen separately from ethics so as to bring effective teaching and learning since considering the culture of the diverse groups will enhances their learning. On the other hand, conceptual culture-oriented eLearning system development framework consists of components such as culture factor (moderate-inform), community factor (shapes), administrative factor(student, learning style, content factor, activity/ exercise factor and teacher as a central component).It focuses on culture component since it is believed that every other component of eLearning, be it the learner as well as the learning environment are affected by culture factor directly or indirectly.

As can be observed from the various models and frameworks explored briefly above, it appears that they share some commonalities and have some differences.

Based on the commonalities it is reasonable to align each of the identified models and frameworks to the basic building blocks that make up an effective education system. In effect, for an effective implementation of an education system, the model or the framework under adoption should span across the three basic building blocks referred to as: Pedagogy, Technology and Human (Madar and Willis, 2014). The exercise being undertaken in this space is thus that of an alignment to the foregoing block so as to ascertain whether a model is worth considering or not. Of course, for those models that do not span across all the building blocks, effort can be made in order to improve them to obtain satisfaction Apart from this, the current emerging models and frameworks incorporate some more building blocks like culture, ethics, evaluation as some are indicated in the frameworks mentioned above.

The pedagogical cluster is the core foundation of any eLearning model or frameworks and deals mostly with the quality of the contents provided to learners. It also deals with the approach, frequency and load provided to learners at any point in time as well as the capabilities of both the learners (to acquire such content) and the teacher (to provide such content). For the purpose of this classification, the pedagogical cluster is further split into the self- explanatory traditional approach

and modern approach. The traditional approach in this context is referred that of rendering contents face-to-face that require the physical presence of teachers and students at the same time, whereas the modern one may not require physical contact but is rather supported by up-to-date technology. The technology cluster is concerned with supporting technological infrastructure required to deliver (and therefore administer) content to the learner. This cluster is further split into two sub-groups namely: interactive and non-interactive technologies. The last cluster which is the human cluster, is concerned with participating stakeholders in the learning value chain. This cluster can be further split into three groups namely: Learners, Teachers and Administrators.

The Table 3.1 below provides an extract of a preliminary classification of eLearning models and frameworks based on the current literature research. The table shows that the eLearning models and solution is a multi-dimensional problem that requires further refinement to clearly articulate the rationale for selecting a given model over another. While the classification here is still of a preliminary nature in the sense that further analysis should be conducted, the table clearly demonstrates that most models span across all the suggested clusters although some may be regarded as obsolete from the perspective of technology advancement.

From the classification, it also appears that hybrid models would be suitable for adoption provided that the required infrastructure supporting such model and framework are available and that targeted audience is comfortable with the model and framework. At the other extreme, Asynchronous, WBT and CBT lack interactivity, which is an important feature of effective eLearning. The traditional model also lacks both flexible and interactive features of effective eLearning which is a sign of inadequacy. The preliminary classification is shown below in Table 3-1.

Table 3-1: Preliminary classification of eLearning models and frameworks

eLearning models/frame-works	Pedagogy		technology		human		
	Traditional	non-tradit-ional	Interactive	Non- inter-active	learner	teacher	admin
Synchronous		✔	✔		✔	✔	✔
Asynchronous		✔		✔	✔	✔	✔
CBT		✔		✔	✔	✔	
Virtual		✔	✔		✔		✔
Adjunct	✔				✔	✔	✔
Mixed	✔				✔	✔	✔
Hexa C model of eLearning		✔		✔	✔	✔	✔
Blended multimedia-based eLearning		✔	✔		✔		✔
Comprehensive Blended learning Framework		✔	✔		✔		✔
Conceptual culture-oriented eLearning		✔	✔		✔		✔

The preliminary nature of such a classification suggests that further work need to be undertaken in order to provide a more rigorous interpretation of the proposed classification. This would of course entails undertaking a deeper characterization of the various eLearning models and frameworks already explored to date and also taping into those still to be investigated. As can also be observed from the various frameworks explored above, there are some more building blocks or categories

of eLearning frameworks, in addition to the building blocks identified for the above classification. These building blocks are identified as culture, ethics, management and evaluation.

3.5.1 Classes of existing eLearning models and frameworks

While doing the preliminary classification of eLearning models and frameworks, three main building blocks namely: technology, pedagogy and human were identified from the literature. More recently, however, additional building blocks; namely, management, evaluation, culture and ethics are identified to further characterise eLearning frameworks. These seven building blocks are considered as classes to compare differences between eLearning frameworks. In reality an eLearning framework may be more prone to either of the seven building blocks or two of the building blocks or three of the building blocks and so on. For example, Adjunct, online and mixed frameworks are more prone to technology. Technology plays a predominant role in such eLearning frameworks since their main emphasis is on the delivery tool not on the course content or institutional readiness and so on. As such, it can be said that in such frameworks, the weights of the technology building block are very high as compared to other building blocks of the frameworks.

The frameworks more prone to pedagogy, such as V-model of eLearning, Hexa C model of eLearning and five stage model of eLearning carry a high weight of pedagogy compared to other building blocks since it gives emphasis on how the course and curriculum is designed, and how the course is delivered (method of instruction).

Blended multimedia-based eLearning and Conceptual culture-oriented eLearning system development framework are among the eLearning frameworks that give emphasis to culture. They are more prone to culture; the weight given to culture is high since culture is the key to treat diverse learners, to select the right instructional tool and content for the right user. Furthermore, A Framework for Adaptation of Online Learning, funnel framework, demand driven eLearning framework are frameworks that give emphasis to three of the classes or building blocks; namely, pedagogy, management and technology. The weight given to these three building blocks are high as compared to other classes or building blocks.

There are also eLearning frameworks that give more weight to all of the seven building blocks although the level of weight may vary from one class to other. These eLearning frameworks can be grouped under Hybrid (Khan's family class) and it is the most recent class of eLearning

frameworks. Blended multimedia, orbital and comprehensive blended learning are also some of the examples that can be grouped under this type of class. Table 3-2 below depicts some example eLearning frameworks that are grouped under the seven classes.

Table 3-2: Classes of eLearning frameworks

no	eLearning models/frameworks	Classes							
		technology oriented	**pedagogy oriented**	**Managerial oriented**	**Culture oriented**	**Institution oriented**	**Evaluation oriented**	**Ethics oriented**	**Hybrid-all (Khan's family)**
	Synchronous	✔							
	CBT	✔							
	Adjunct	✔							
	Hexa C model of eLearning		✔						
	Blended multimedia-based eLearning	✔	✔	✔	✔	✔	✔	✔	✔
	Comprehensive Blended learning Framework	✔	✔	✔		✔	✔	✔	✔
	Conceptual culture-oriented eLearning	✔	✔	✔	✔	✔	✔		

3.6 Chapter Conclusion

This chapter starts by exploring the literature of eLearning models and frameworks. In doing so, each of the concepts is described as well as their advantages and limitations. It is demonstrated that the two concepts are correlated; or more precisely, frameworks are used to derive models.

The chapter is completed by presenting a preliminary classification of eLearning frameworks and models and subsequently some classes of eLearning frameworks are derived based on a proposed classification and characteristics of some recent eLearning frameworks. The aggregation of the foregoing contributed to achieving the main objective of this chapter which is an investigation of existing eLearning frameworks and models and then characterise them. It is clear from this chapter that there is a significant number of frameworks and models in the literature, making it cumbersome for selection by institutions. This challenge is overcome in the next chapter by proposing a conceptual generic eLearning framework.

4 CHAPTER FOUR: A GENERIC eLEARNING FRAMEWORK

4.1 Introduction

In the era of the internet and the knowledge economy that demands an increasing number of educated people, adoption of eLearning is not an option but a necessity. As a result, eLearning is widely used at many higher education institutions despite problems such as: (i) weak infrastructure, (ii) lack of strategy and policies, and (iii) a lack of pedagogical concern. It appears that eLearning is often adopted without a rigorous needs assessment, or maturity assessment being done by the learning institution. Furthermore, a profusion of eLearning frameworks has been produced, presented, and explained without any consistency, making it challenging to pick and use a suitable eLearning framework. As such, further analysis of the existing eLearning frameworks is required to understand their commonalities and differences and so present a consistent view of a framework to facilitate decision making.

The purpose of this chapter, therefore, is to analyse, compare and synthesise features of existing eLearning frameworks and models as discussed in Chapter 3, to develop a generic framework and a methodology for eLearning adoption by learning institutions. The generic eLearning framework will be of significant importance for the discussion of the development of an eLearning framework taxonomy in the next chapter, the proposed methodology might then be used as a guide for choosing an applicable eLearning framework and evaluating the maturity of the institution's current eLearning framework. To this end, the following research question is to be answered by the chapter:

How are a generic eLearning framework and a methodology for eLearning adoption developed?

Furthermore, the intention behind the proposed generic framework is also to rely on such a formalism to derive new frameworks that may not yet exist in the literature, and thus enrich the knowledge base. This researcher will also rely on derivations for cross-comparison and gap analysis with existing frameworks. The generic eLearning framework has practical real-life applications. For example, when conducting a maturity assessment of a learning institution’s existing framework, one or more stages could have characteristics that are related to a derivative

from the generic eLearning framework. The gap revealed by this analysis can then be used to develop a plan to improve the maturity level by using the anticipated methodology.

The remainder of this chapter is organised as follows: Section 4.2 presents the characterization of eLearning framework through discussing preliminaries and building blocks. In section 4.3, formal characterization of an eLearning framework will be discussed. An explanation of how the generic framework can be exploited efficiently, the derivation of new frameworks, and the maturity assessment of learning institutions will be given in sections 4.4. This researcher's proposed conceptual methodology for eLearning adoption by institutions is presented in section 4.5; followed by the chapter's conclusion in section 4.6.

4.2 Characterisation of eLearning Frameworks

4.2.1 Preliminaries

A number of basic definitions presented in this section will be used throughout this chapter to strengthen not only its context, but also to help develop a clear understanding of the purpose, of the characterisation and usefulness of eLearning frameworks.

4.2.1.1 Element

In the context of this research, an element (e) is defined as the most basic, non-decomposable, or atomic, substance of an abstract component. As such, an element cannot be further refined, although it may be possible in some context, to do so. It is therefore the most basic representation of something that contributes to the overall building block of a component.

- ***Metric of an element*** $(\boldsymbol{m_e})$

  Metrics are measures used to track, assess, and evaluate the status or performance of a specific element within an environment. In the context of eLearning frameworks, metrics are used to assess the performance of an element. A metric is a measure that gives information about how well an element performs according to an established standard or best practice. In the context of this research, the metric associated with an element (e), will be denoted by the symbol (m_e). Although metrics are usually quantifiable, quality-based metrics are also acceptable depending on the context. Quantifiable metrics often have some unit of measurement, such as cost, age, distance or other relevant quality associated with them that differentiate one element from another.

- ***Weight of an element*** $(\boldsymbol{W_e})$

  The weight of an element (W_e) is defined as the degree of importance an element has compared with other elements within a specified environment. The attribution of the weight of an element, within a group of elements, is contextual, and must be determined according to some domain-specific guidelines set out in the environment as best practice. For this research, the weight of an element will be determined by using a six-level Likert rating scale.

Very High Importance	High Importance	Medium Importance	Low Importance	Very Low Importance	Not Important
5	4	3	2	1	0

  The weight of an element (W_e) could be assigned any value between 5 and 0 depending on the importance of the element.

- ***Scoring factor of an element*** $(\boldsymbol{S_e})$

  The scoring factor or score of an element (S_e) is a function of the actual value of its assessed metric. That is, within an environment, the actual measured metric of an element has to be determined. The outcome of such a determination will inform on the score of that element in the environment and determine whether the value obtained meets expectation or not. A six-level Likert rating scale is also used to determine the scoring factor.

Exceedingly Satisfy	Substantially Satisfy	Satisfy	Partially Satisfy	Weakly Satisfy	Doesn't Satisfy
5	4	3	2	1	0

  For an element (e), the score of that element (S_e) could be assigned any of the values between 5 and 0 depending on the performance of its measured metric.

- ***Weighted Score of an element*** $(\boldsymbol{W'})$

  The weighted score of an element is the product of its weight and its scoring factor. In this research the symbol (W') used to denote a weighted score.

  Let:

  W_e = weight of element (e)

  S_e = scoring factor for element (e)

Then:

$$W_e' = W_e S_e \quad [1]$$

4.2.1.2 Component

A component, represented by the symbol(C), is regarded as a set of elements. It is made of a group of elements as previously defined, and may be regarded as a complex element, as opposed to the atomicity of a given element. A component is thus composed of an aggregated set of elements of various purposes grouped together to achieve a specific objective within a defined problem domain.

Let $C = \{e_1, e_2, e_3, \ldots\ldots e_n\}$ [2] be a component consisting of $n\ elements\ e_{i;i=1\ldots\ldots n}$

- ***Weight of a component*** $(\boldsymbol{W_c})$

  The weight of a component is defined as the degree of importance a component has compared with other components within a specified environment.

- ***Scoring factor of a component*** $(\boldsymbol{S_C})$

The scoring factor of C denoted S_C is obtained by dividing the sum of all elements' weighted score by the sum of all elements' weights within that component:

Let:

S_c = scoring factor of component (C), where $C = (e_1; e_2; e_3 \ldots e_n)$

W_{e_i} = weight of element (e_i), where $(i = 1 \ldots n)$

S_{e_i}= scoring factor of element $\left(e_{i;i=1\ldots n}\right)$

W_{e_i}' = weighted score of element $\left(e_{i;i=1..n}\right)$

$$S_c = \frac{\sum_1^n W_{e_i}'}{\sum_1^n W_{e_i}} = \frac{\sum_1^n W_{e_i} S_{e_i}}{\sum_1^n W_{e_i}} \quad [3]$$

- ***Weighted score of a component*** $(\boldsymbol{W_C'})$

The weighted score of a component is the product of the weight of the component within a building block and its scoring factor. In this research the symbol (W') used to denote a weighted score.

The weighted score of the component will then be

$$W_C' = W_c S_c = W_c \frac{\sum_1^n We_i Se_i}{\sum_1^n We_i} \quad [4]$$

4.2.1.3 Worked Example

A worked example will be used to illustrate the concepts as described. A component, referred to as Software Acceptance, $(C_{SoffAcc})$ comprises four elements; defined mathematically as $C_{SoffAcc} = \{e_1, e_2, e_3, e_4\}$, where:

- e_1 = Performance, measured in bits per second (bps);
- e_2 = Usability, measured qualitatively;
- e_3 = Capacity, measured in megabytes (MB); and
- e_4 = Cost, measured in rand (R)

A weight (W_{e_i}) may be assigned to each of the elements depending on context and their degree of importance within the component. Assume the following weights have been assigned: $W_{e_1} = 4$, W_{e_2} = 5, W_{e_3}= 3, W_{e_4}= 2.

The scoring factor for each of the elements will be a function of its measured value. If, for example, the measured performance (e_1) is 1024bps; usability (e_2) is very high; capacity (e_3) is 200 MB; and cost (e_4) is R1000, the following scoring factors may be assigned to the four elements: $S_{e_1} = 3, S_{e_2} = 4, S_{e_3} = 2, S_{e_4} = 2$

Using equation [3] the scoring factor of the component will then be

$$S_c = \frac{\sum_i^4 W'_{e_i}}{\sum_1^4 W_{e_i}} = \frac{\sum_1^4 W_{e_i} s_{e_i}}{\sum_1^4 W_{e_i}} = \frac{(4X3)+(5X4)+(3X2)+(2X2)}{4+5+3+2} = \frac{12+20+6+4}{14} = \frac{42}{14} = 3$$

If it is further assumed that the above component is part of a group of components and has a weight of 4 within that group. The weighted score for the group would be calculated as follows using equation [4]:

$$W'_c = W_c S_c = 4 \times 3 = 12$$

4.2.1.4 Building Block

A building block is defined as a group of components with common characteristics whose collective contribution is that of fulfilling the building block's goal. It then consists of a range of fully defined components that are in turn made of elements in such a way that their grouping nature fulfills a given purpose.

Let $B = \{C_1, C_2, C_3 \dots C_m\}$ [5]be a building block consisting of$m$componentsC_j ;$j = 1, \dots, m$, where

$$\begin{cases} C_1 = \{e_{11}, e_{12}, e_{13,} \dots e_{1n}\} \\ C_2 = \{e_{21}, e_{22,} e_{23,} \dots e_{2n}\} \\ C_3 = \{e_{31}, e_{32}, e_{33,} \dots e_{3n}\} \\ C_m = \{e_{m1}, e_{m2}, e_{m3,} \dots e_{mn}\} \end{cases}$$

Then $B = \{C_j\,; j = 1..m\}; C_j = \{e_{ji}\,; i = 1..n\}$

- ***Weight of Building Block*** (W_B)

The weight of a building block is defined as the degree of importance a building block has as compared with other building blocks within a specified environment.

Let $W_B$be the weight of the building block$B$

- ***Scoring factor of Building block*** (S_B)

The scoring factor of B denoted byS_B is obtained by dividing the sum of all components' weighted scores by the sum of all components' weight within that building block.

$$S_B = \frac{\sum_1^m W'_{C_j}}{\sum_1^m W_{C_j}} = \frac{\sum_1^m w_{c_j} s_{c_j}}{\sum_1^m w_{c_j}} \quad [6]$$

- ***Weighted score of Building block*** $(\boldsymbol{W'_B})$

The weighted score of a building block is the product of the weight of the building block within a framework and its scoring factor. In this research the symbol W'_B is used to denote a weighted score of a building block.

The weighted score of the building block will then be:

$$W'_B = w_B s_B = W_B \frac{\sum_1^m w_{c_j} s_{c_j}}{\sum_1^m w_{c_j}} \quad [7]$$

Where

$$S_{c_j} = \frac{\sum_{i=1}^n w_{e_{ji}}\, s_{e_{ji}}}{\sum_{i=1}^n w_{e_{ji}}}$$

Then

$$W_B' = W_B \left(\frac{\sum_{j=1}^{m} w_{c_j} \left(\sum_{i=1}^{n} w_{e_{j_i}} s_{e_{ji}} \Big/ \sum_{i=1}^{n} w_{e_{ji}} \right)}{\sum_{j=1}^{m} w_{c_j}} \right)$$

Assuming that building blocks in turn form part of a larger group, the above equation [7] could be relied upon to assess the performance of each building block within the group based on its weight, scoring factor, and actual score. Such calculation will be delved into the section on framework evaluation.

4.2.1.5 Framework

A framework is defined as an aggregated set of building blocks of which individual weights collectively contribute to its goal and maturity. Figure 4-1 below depicts a high-level representation of a framework taking into consideration all the foregoing concepts.

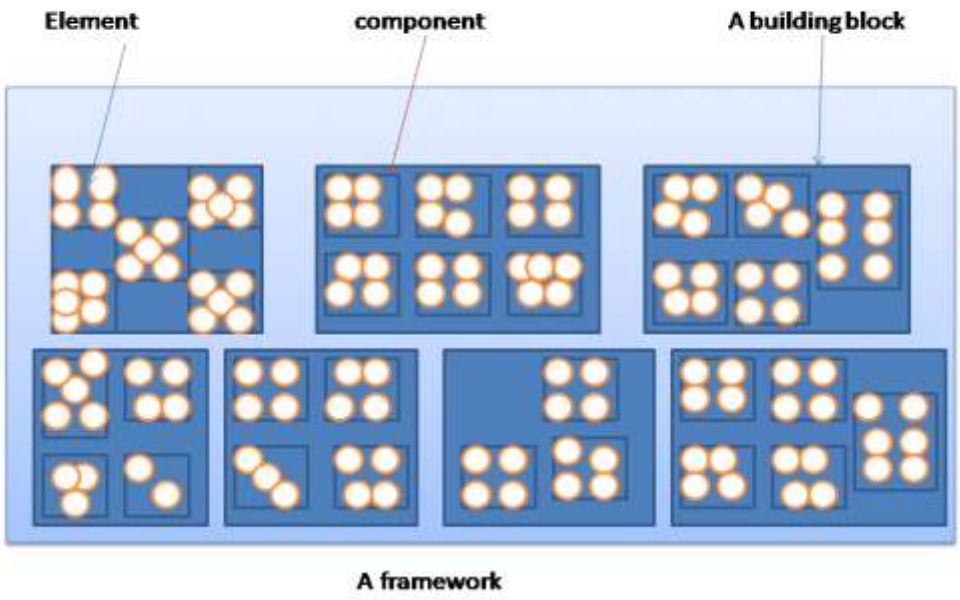

Figure 4-1.An Illustration of a Framework, Components, and Elements

4.2.1.6 Maturity level of a framework

Frameworks can be described in terms of their maturity, or capability, of delivering a required level of performance. The maturity of a framework is defined by the phase, or level, of achieving a mature status. A framework would be considered to be mature when all the building blocks that make up that framework achieve a high score in specifically defined factors. It can also be regarded as the scoring factor of the framework.

In the context of this research, a five-level framework maturity will be relied on and defined as follow: This research aims to develop a five-level maturity framework that can be relied on to evaluate the performance of an eLearning model. The framework can be defined as follows:

Let (f) be a framework consisting of 1 $to\ p$ (B) building blocks $\{B_1, B_2, B_3, \dots, B_{p-1}, B_p\}$.

The Maturity M_f of the framework will be defined as:

$$M_f \equiv \{L_{5\rightarrow Optimizable}\ L_{4\rightarrow Manageable}\ L_{3\rightarrow Defined}\ L_{2\rightarrow}\ Basic\ L_{1\rightarrow}\ Poor\ \}$$

Levels of framework maturity are representing using 5 levels shown in the table below.

Levels of Maturity Framework (*f*)

Level 5	Level 4	Level 3	Level 2	Level 1
Optimizable	Manageable	Defined	Basic	Poor

The maturity of the framework is determined by calculating the scoring factor (S_f) of the framework based on the following equation:

$$S_f = \frac{\sum_1^p W'_{B_k}}{\sum_1^p W_{B_k}} = \frac{\sum_1^p w_{B_k} S_{B_k}}{\sum_1^p W_{B_k}} = \left(\frac{\sum_{k=1}^p W_{B_k} \left(\sum_{j=1}^m w_{c_{kj}} s_{c_{kj}} / \sum_{j=1}^m w_{c_{kj}} \right)}{\sum_{k=1}^p w_{B_k}} \right)$$

The result obtained informs on the maturity level by mapping the score factor to the maturity index. Therefore,

$$\mathrm{S_f = i \rightarrow L_i; i\epsilon[0,5]}$$

The above formula concludes the preliminary exercise aimed at identifying basic concepts required to achieve one of the goals of this research which is that of formally characterizing eLearning frameworks. By relying on the formalisms covered in this section, a range of generic concepts aimed at representing the framework will be provided easily and also it will be able to show how derivation and evaluation can be done seamlessly.

In the next section, a range of building blocks applied in the eLearning context will be explored. Such building blocks will form the basis for our formal characterization of eLearning frameworks. The maturity level L of a framework is a function of the framework's maturity determined according to some predefined threshold such that, when the calculated framework maturity is below or equal to a predetermined value min, the level is said to be at its lowest level(L_{min})and when it is above or equal to a predetermined value max the level is said to be at its highest level $L_{(max)}$

Maturity at its lowest level suggests that more work is still needed to be done to improve on the weight of the various building blocks to attain the highest possible maturity level. Maturity at its highest level suggests that the framework is of a high standard and delivers quality throughput. For sake of consistency and without loss of generality, any maturity level falling exclusively betweenL_{min} and L_{max}will be referred to as an intermediary maturity level denoted by L_{int}

Therefore, the maturity level $L_{(f)}$of a framework can be generically defined as

$$L(F) = \begin{cases} L_{min} if\ M_f \leq min \\ L_{int}\ if\ min < M_f < max \\ L_{max} if\ M_f \geq max \end{cases}$$

It is worth noting that L_{int} is not unique and can be split into many variants depending on how structured has to be the maturity level of a given framework for decision making.

In the next section, a range of building blocks applied in the eLearning context will be explored. Such building blocks will form the basis for the formal characterization of eLearning frameworks.

4.2.2 eLearning Framework Building Blocks

Building blocks that make up different eLearning frameworks have been identified and described in the existing literature. Owing to the significant number of building blocks available, this research has focused on seven generic building blocks that this researcher has identified as being significant in the perspective of Ethiopian higher education institutions, and which have been included in existing research. Zanamwe (2010), for example, has found that many of these building blocks are relevant in the context of Zimbabwean institutions of higher learning. The seven building blocks that form the basis for this research are: Institutional, pedagogy, culture, technology, management, evaluation, and ethics. These blocks allow for easy identification of commonalities and differences between eLearning frameworks. The elements and components that make up each building block, as well as their associated metrics and weights will now be described and discussed.

- ***Institutional***

  Online or distance learners require higher levels of service and clarity on what will be learned than face-to-face learners. As a result, institutions of higher education require a clear online and distance learning strategy. Institutions should be prepared to provide high-quality education with the most up-to-date learning resources and support. Administrative affairs, academic affairs, and student services are all components of an institution building block, which is one of the building blocks of the generic eLearning framework. (Elameer, & Idrus, 2012). Each component is made up of several elements. The administrative affairs component is comprised of elements such as: information technology services, Admissions, payment, and instructional development and media services. The academic

affairs component incorporates elements like faculty and staff support, instructional affairs; which includes information about instructor and tutor, and instructional quality; class size, workload, compensation, and intellectual property rights. Program information, orientation, advising, counselling, financial aid, library help, bookstore, social support network, tutorial services, internships, and employment services are all part of the Student Service component.

Various metrics to measure each element can be defined according to the standard best practice associated with that element. For example, the budgeting element in the administrative affairs component can be measured in terms of a cost at a given currency. Also, the orientation element within the student service component can be measured in terms of the number of students oriented through the system.

Furthermore, according to Masoumi and Lindstrom,(2011), the effectiveness of an institutional building block can be judged by how well it carries out its mission and goals, as well as how well it utilizes its diversified resources for managing and organizing various resources, such as physical and human resources. The quality of an institutional building block could also be measured from the perspective of the structure of the institution, current and prospective constituents, academic procedures, and the like. This argument is thus in line with this researcher's approach to identify metrics and rely on best practices for associated weights attribution. For example, the budgeting element may have more weight than the alumni affairs element within the administrative affairs component. Introduce the table here

Table 4-1: Some example metrics of the institutional building block

Building Block	Components	Elements	Metrics
Institutional	Administration	Admissions	-the number of students who apply for a program -the number of students who are satisfied with the application process -the number of students who register for a program -the number of students who are satisfied with the registration process…
		Finances	-percentage of the budget used for eLearning implementation…
		Payments	-the number of students who pay for the course through the system -the number of students who successfully pay and are satisfied with the process….
		IT services	-percentage of students with computer access -percentage area of university covered by wireless internet access…
		Policies	-The number of courses developed based on the eLearning policies and standards -the existence of a copyright policy -the existence of an eLearning policy -the applicability of an eLearning policy for course development…
	Academic Affairs	Faculty and staff support	-the number of staff and faculty members that are provided with the necessary skills and knowledge gap training -the existence of incentives for teachers who participate in the development of eLearning courses -consideration of copyright issues for eLearning content produced -the existence of financial support for faculty to conduct research, attend conferences, and presentation of papers at professional meetings…
		Instructional affairs	-the ability of the system to provide information on the faculty-to-student ratio -provision of the same sense of academic quality in eLearning as expected in traditional courses -provision of information about advising -provision of information about workload…
		Academic Computing Services	-facility for the institution to manage application software and servers for courses -provision of email accounts, disk space for web pages, and technical support for students, faculty, and staff…
	Student Services	Orientation	-provision of orientation about the procedure of learning - provision of information about how many users are oriented through the system -provision of information about the role and responsibilities of instructors and learners…
		Bookstore	-provision of book store services for learners - availability of the number of students provided with bookstore services -information on learner satisfaction with services provided…
		Library Support	-provision of library facilities for learners -information on the number of learners provided with library services -information on learner satisfaction with library facilities and service…

- ***Pedagogy***

  This building block comprises issues on how teaching and learning are carried out. It consists of two main components: Content, and Methods; and under these two components, elements such as content (body of the course), instructional objectives, design approach, course organisation, methods and strategies are incorporated (Elameer & Idrus, 2012; Madar and Willis, 2014; Hagos, 2019). In line with this, it is argued that to generate a successful teaching and learning environment, clear learning outcomes and clear objectives for each section of the course should be specified (Davies, 2004).

  The content element, of the Content component, focuses on the quality of domain knowledge. This includes the course subject matter, and the type and accuracy of the course content. The second element in the Content component, is the design element approach. This element is concerned with selecting the pedagogical philosophy to be adopted (instructivist, constructivist, or some other philosophy). It is critical to identify the eLearning design approach as well as the role of instructors and students in the teaching-learning process. If the design approach allows for the instructor to serve as a facilitator, or provides a student-centered learning approach, the facilitation can occur using tools such as email, online discussion, audio conference, video conference, and so on (Elameer & Idrus, 2012).

  The instructional method element, is about the different methods used to deliver the course. The instructional method may vary based on the context, content, and objective of eLearning (Elameer & Idrus, 2012). For example, the presentation method is more suitable for conveying concepts, facts, procedures, and principles. Text, slideshows, audio snippets, video clips, and video conferencing are all options for online delivery. Supplemental (offline) materials such as print, audio, videotapes, etc. can also be mailed to learners. The demonstration method, on the other hand, is more appropriate for teaching procedures and equipment operation, exemplifying principles, and demonstrating interpersonal skills. This can be done using video clips, audio clips, and video-conferencing, or through other simulation tools. Drill and Practice is another instructional method that encourages students to practice basic skills or memorize knowledge on a regular basis, and it is more appropriate for teaching mathematical facts, reading comprehension, foreign languages, vocabulary, basic science, middle-school history, and geography. Web-based drills and practices can

be designed using programming languages like the Hypertext Markup Language (HTML) or JavaScript. Tutorials are another method of instruction. A web-based tutorial can be done in a presentation-response-feedback fashion. This method involves presenting content and asking questions after each block of lessons. The student is required to come back with answers, which the teacher then marks and provides feedback. Games are highly motivating instructional tools that can be utilized in web-based courses to assist learners improve abilities including decision-making, problem-solving, interpersonal relationships, leadership, and cooperation. There are various strategies in the teaching-learning process that are effective for varied contexts and subject, such as storytelling, simulations, role-playing, dialogues, interaction, modelling, facilitation, collaboration, debate, field excursions, and apprenticeship. (Elameer & Idrus, 2012).

The content organisation element in the pedagogy building block deals with the organisation of content in sequence so as to help students achieve their objectives. Use of visuals that are pertinent to the content, such as icons, buttons, photos, and images; multimedia components, such as: Sound, audio, or video, as well as effective language, are also deemed important and will improve content clarity. Clear directions of course instruction, and a sense of continuity in courses should also be considered in the organisation of content.

Based on the above explanation, various metrics to measure each element can be suggested. Among others, student-centeredness (whether there is a student-centered approach or not), communication and interactivity, learning environment, assessment, social aspects, the relevance of learning content, the structure of learning content, clear instruction, and relevant tasks can be considered as indicators to measure pedagogical elements, so as to achieve the right pedagogy (Masoumi & Lindstrom,2011). As an illustration, student-centeredness can be evaluated in terms of the number of students who participate actively in any discussions, or question and answer sessions. Clarity of course instruction is another example of a metric in this building block. Accordingly, weights can be given to each element based on the level that the element contributes to achieving the right pedagogy. Table 4-2 illustrates some examples of metrics in the pedagogy building block.

Table 4-2: Some example metrics of the pedagogy building block

Building Block	Components	Elements		Metrics
Pedagogy (teaching-learning)	Content	Goals/objective	Clear learning outcome and objectives	Percentage of clarity in the learning objectives and outcomes. Percentage of clearly aligned learning goals, activities, assessments, and learner characteristics
		Content clarity	the type and accuracy of course content	-percentage of course content accuracy - a percentage of concepts presented in a balanced manner with an acceptable amount of detail
		Organisation of course	Use of graphics that are relevant to the content Grammar usage that is effective Well stated course instruction Continuity in the courses offered	-percentage of relevant graphics in the eLearning course - percentage of clear instruction for the course - Percentage of continuity of the courses offered in eLearning system
	Methods	Design approach	Pedagogical philosophy Role of instructor and students.	- Existence of a pedagogical philosophy that permits a teacher to operate as a facilitator (student-centered approach) or as the primary actor. -number of tools such as email, discussion forum etc., to facilitate discussion or chat.
		Methods and strategies	Context, type of content, and objective of the course matter the instructional method applied	-percentage of appropriate methods for specific content and objective
		Medium of eLearning environment	Mixture of media	-percentage of a mixture of media that are used in the eLearning environment
		Human resource support	Online support Teaching and learning support	-number of students provided with the necessary skill to participate in online learning

Culture

The Culture building block consists of two components namely; and socio-economic and politics aspect. Their corresponding elements are economic, social, political, language, and religious diversity (Zanamwe, 2010). The purpose of taking culture into account in eLearning is to be able to provide high-quality web-based courses to learners from all walks of life, regardless of their social, economic, linguistic, or religious backgrounds. The diversity of culture and learning styles should be acknowledged when creating web-based learning environments, according to the argument, so that varied learners can benefit from the system. One of the most critical issues is cross-cultural communication. We must keep in mind that, beyond the actual words said, there are significant cross-cultural variances in contact and communication. According to Masoumi, 2011 & Lindstrom, 2009 cited in Zanamwe, 2010, the inclusion of a cultural dimension when developing an eLearning framework is nothing more than a move to improve the quality of eLearning. In reality, it goes beyond simply assisting learners with their identity or assisting learners in learning through examples from their community (Masoumi & Lindstrom 2009 cited in Zanamwe 2010). Culture is a vital building block that allows education on various levels, influences design and use, and influences the various actors involved (for example: designers, teachers, administrators, students).Technology use is also influenced by culture (Zanamwe, 2010).

Various metrics can be suggested to measure elements of culture, for example: A teacher may be perceived as being authoritative in one culture, but is perceived to be a friend in another culture. Individual merit is recognised in one culture, whereas, social relationship is considered more important in another. Students' attitude to achievement versus a more relaxed attitude may also be culturally-driven, and therefore, could be an important metric. Communication is also influenced by culture; the way learners communicate with each other, and with their educators and tutors within an eLearning environment could be an important metric within the cultural component. (Aguti, Walters and Wills, 2013). With regards to beliefs and attitudes towards eLearning among learners and teachers, the question could be asked whether metrics can be used to measure positivity or otherwise of their attitudes.

Academic achievements with eLearning and societal norms concerning eLearning are some other metric indicators of the culture building block. Furthermore, honor, obedience, respect and regard for authority, mutual bonding, and friendship are all depending on one's cultural concept. They are crucial for effective online discussion, and as a result, should be considered in the design and implementation of any eLearning programme.

The weight of each element in culture can also be calculated based on the level of contribution each has towards the successful implementation of eLearning. The table 4.3 below shows the summary of culture building block with its corresponding metric elements.

Table 4-3:Some example metrics of culture building block

Building Block	Components	Elements	Metrics
Culture	Socio-economic aspect	Social diversity	- the extent to which the eLearning system considers social diversity among learners -the extent to which the eLearning system indicates learner attitude -achievement consciousness or relaxed
		Economic diversity	-the extent to which the eLearning system considers economic diversity among learners
		Language diversity	-the extent to which the eLearning system measures the number of effective communications learners have with others -the extent to which the eLearning system caters for use of jargon, icons, idioms, ambiguous or cute humour, and acronyms that have different meaning in different cultures
	Politics aspect	Political diversity	-the extent to which the eLearning system considers political diversity among learners
		Religious diversity	-the extent to which the eLearning system measures the number of effective communications learners have with others

- ***Technology***

Infrastructure & resource as well as interface design aspects are the main components in the technology building block. The elements that make up the technological infrastructure of an organisation include: infrastructure planning, hardware requirements, software requirements, operating systems, internet connection and internet services for instructors and learners (Aguti, Walters and Wills, 2013; Hagos, 2019). Furthermore, this researcher's review of current literature suggests that technical support, online and offline resources support are also included with in the infrastructure and resource component. In addition, interface design can be considered as the other component of the technology building block. From a technology support perspective, besides a comprehensive set of Service Level Agreements (SLA), that should be put in place to provide quality eLearning, soft issues, such as that of the availability of adequately trained personnel to assist learners to set up, and use systems should be considered, these include: setting up hardware and software for desktop video conferencing; providing guidance for students on how to send emails and attachments; installing software; scanning pictures; downloading and printing webpages; and creating an on-line presentation using presentation software. These are all issues that need attention, and are essential for successful performance of this building block.

A number of different metrics to measure components and elements in the technology building block can be suggested. For example; the number of errors the software generates could be an indicator of the quality of a Learning Management System (LMS). An additional metric to measure the effectiveness of the technology building block could be the amount of time the technology requires to accomplish a given task.

Additional metrics for evaluating the quality of components and elements in the technology building block include the development and sustainability of technological infrastructure, the functionality of technological platforms, accessibility, interface design, navigation, learnability, memorability, time to complete a task, and error handling (Pakiso, Khomokhoana & Scientiae, 2011)

The weight of each element can also be allocated based on the level of contribution each makes towards the success of the building block. This can be based on learners' opinions and existing research results. The table below summarises components and elements of the technology building block with their corresponding metrics.

Table 4-4:Some example metrics of technology building block

Building Block	Component	Elements	Metrics
Technology	Infrastructure & resource aspect	Workforces to assist students in getting started on the course	-the number of staff involved for the assistance of learners to start the course. - the extent to which the staff is effective in assisting learners
		Budgeting hardware, software, and internet	-the cost of hardware, software, and internet
		Hardware requirement	-the extent to which hardware requirements are fulfilled
		Software requirement	-the extent to which software requirements are fulfilled
		Technical support	- the amount of information available on how to set up video conferencing hardware and software. - the availability of guidance on how to send emails and attach files
	Interface design aspect	Aesthetics	-the availability of different aesthetic features within applications to help learners perform their tasks
		Design	-clarity of instruction in the application -availability of descriptions of what the learner should do in each step of eLearning
		Usability testing	-measure of the amount of time an application takes to complete a task -measure of the number of errors users encounter when using an application

- ***Management***

The management building block consists of two main components: learning environment maintenance and information distribution management (Khan, 2005). Maintenance of the learning environment includes elements such as management of course content, staffing, budgeting, and learning resources, mechanisms for evaluation, and security measures. Additional elements that should be addressed in the maintenance of the learning environment include: determining the appropriateness of the available course content and creation of new content; managing permission to access learning content, and to use copyrighted information and materials. Methods to handle student submissions, online quizzes, and assessments, also form part of the maintenance of the learning environment component.

Information distribution is the second component of the management building block. Schedules, syllabus, announcements, course pertinent contact information, learning and testing materials, and students' marks from quizzes, assignments, exams, and projects are among the topics covered in this component. Notifications about any changes in due dates or other course relevant matters via email, announcement page, alert boxes, and phone-call mail, are also elements of this component. Additionally, the provision of backup materials and alternative activities for students, when access to the courseware or online discussion forum is either not operating properly or unavailable during a scheduled lesson period, is also an issue that should be addressed by the managing information distribution component.

Pedagogic, administrative, technical support are some of the metric indicators that should be measured to assess performance and quality of management building block (Masoumi & Lindstrom, 2011)

Pedagogic support, for example, can be measured in terms of the availability of appropriate content and learning materials. Typical metrics to assess the degree of pedagogic support could include: How many teachers are appropriately assigned to prepare the right course content; whether learners pleased with the course content, and the number of learners who are satisfied with the course content versus the number who are not. Administrative support can be measured in terms of the number of learners who are able to log into the system easily, and the number of learners who successfully submit their assignments and quizzes on time. Similarly, technical assistance can be measured by the amount of backup material provided, the number of learners who comprehend notification messages, and the number of learners who successfully communicate via email, discussion forums, and other means.

The weight of each element can also be assigned based on the contribution the element makes towards the success of the management building block. The allocated weight can be based learners' opinions and existing research results. Figure 4-5 summarises the components and elements of the management building block and their corresponding metrics.

Table 4-5:Some example metrics of management building block

Building Block	Component	Elements	Metrics
Management	Information distribution Managing	Schedule, syllabus, announcements, course relevant contact information, learning and testing materials, and students' grades from quizzes, assignments, exams, and projects	-clarity of announcements, schedule and course-relevant contact, and to what extent - number of learners who successfully submit their assignments, quizzes, on time -number of teachers who successfully upload their teaching materials -percentage of learners who communicate with the system successfully -number of learners who can access grades -number of learners who are satisfied with grade accessing process
	Learning environment Maintenance	Staffing, budgeting, management of course content and learning resources, mechanisms for evaluation, and security measures	-appropriateness of teachers assigned to prepare courses -number of learners who successfully log in to the system easily. -success rate of course content being uploaded to the appropriate users

- ***Evaluation***

The two key components of this building block are the evaluation of the learning program's effectiveness and the performance of each student. (Khan, 2005; Hagos, 2019). Online evaluation of web-based learning includes assessment of learners' performance, and evaluation of the instruction and learning environment. Assessment of learners' academic performance is an essential element in the evaluation building block. Issues for consideration include mechanisms for accurately measuring learner performance online, as well as mechanisms designed to prevent cheating. Learner feedback, through the provision of mechanisms to allow learners to evaluate the learning environment online, should be addressed in this building block. For example, by incorporating an instant feedback button on webpages, learners could be encouraged to provide feedback designed to measure satisfaction, as well as improvement of course content and delivery. Feedback design is therefore an essential element in the evaluation building block.

A number of key metrics can be proposed to measure the quality of performance of the evaluation building block.

These include: Cost-effectiveness of the eLearning system, learning effectiveness, learner effectiveness, and teacher satisfaction (Masoumi & Lindstrom, 2011). The amount of money saved by using the eLearning system can be used to determine cost-effectiveness. Learner effectiveness could be measured by the number of learners who achieve a pass. Learning effectiveness could be measured by the number of learners who exit the system having achieved their education. Another metric that could be used are the number of learners who are caught cheating.

The weight of each element can be assigned on the level of contribution each makes towards the success of the evaluation building block. This can be assigned using learners' opinions and existing research results. Figure 4-6 summarises components and elements of the evaluation building block and their corresponding metrics.

Table 4-6: Some example metrics of evaluation building block

Building block	Component	Elements	Metrics
Evaluation	Assessment of learning	learners' academic performance	-performance of learners on courses using grades
		Learner satisfaction	-degree of learner satisfaction with the course
	Assessment of environment	Assessment of the learning environment	-stakeholders' satisfaction with the system. The extent teachers', learners' and other stakeholders are satisfied with the system -cost-effectiveness of the eLearning program -cost of the eLearning system compared to traditional learning system
		Assessment of content creation processes	-the extent to which the content development process is effective
		Assessment of individuals involved in content creation process	-the extent to which experts involved with content creation are competent
		Assessment of institutional eLearning program.	-the extent to which learners are satisfied with the eLearning program

- ***Ethics***

  Educational ethics can be defined as providing equitable educational opportunities to all people regardless of nationality, gender, ideological differences, or mental or physical disability. Ethics is also about what people should do in terms of morality, value, and justice (Toprak, Ozkanal, Aydin, and Kaya, 2010). In addition, ethics deals with policies and guidelines, privacy, plagiarism, and copyright issues. In many of the existing eLearning frameworks, culture and ethics are considered as one and the same component, but current thinking suggests that the two issues are so broad they should be treated separately to address the issues that could impact the effective implementation of an eLearning system (Zanamwe, 2010). When it comes to ethics and providing educational opportunities to everyone, universal internet connectivity and access to information are major concerns.

  In this study, information accessibility as well as legal issues and protocols are the two components of the ethics building block. A number of metrics to measure ethics in education can be suggested, including: The existence of policies and guidelines that condemn plagiarism; the number of courses that are prepared that take diversity of learners into consideration, and the number of courses that employ a variety of educational tactics and activities to accommodate various learning styles. In addition, metrics relating to the provision of internet services, bandwidth, and allowing access for different groups of learners could also be included in the ethics building block. This researcher also suggests that the effectiveness of policies or strategies to evaluate, and take action against, academic misconduct and inequity of learning opportunities could be considered as indicators to measure the success of this eLearning building block.

  The weight of each element can also be assigned based on the level of contribution the element makes towards the success of the ethics building block. This can be allocated based on learners' opinions and existing research results. Table 4-7 below summarises the components and elements of the ethics building block and some corresponding metrics.

Table 4-7: Some example metrics of ethics building block

Building Block	Component	Elements	Metrics
Ethics	Information accessibility	Geographical diversity	-the extent to which geographical diversity among learners is a challenge to set schedules in the learning process - the extent to which synchronous communications for all time zones are arranged at suitable times
		Learner' skill diversity	- how well courses are built to support various learning styles and allow students to adapt to personalised distributed learning environments at their own speed
		Information accessibility	-the extent to which accessibility of information is available to any user -the extent to which the digital gaps among learners is considered and accommodated -the extent to which bandwidth differences are considered in course development
	Legal issues and Protocols	Mutual respect policy	-the extent to which rules governing mutual respect among learners in discussion groups exist and are implemented -the extent to which rules governing learner behaviour and posting hurtful messages in online discussions exist and are upheld -the extent to which policies and guidelines preventing plagiarism exist and are upheld -the extent to which learners participating in online webpage-based learning know, understand, and respect copyright and related issues
		Guidelines, privacy, plagiarism, and copyright	

4.3 Formal Characterization of an eLearning Framework

In this section, seven building blocks are used to suggest a generic eLearning framework. These building blocks: institutional, pedagogy, culture, technology, management, evaluation, and ethics, have been described previously. The objective of formally characterising an eLearning framework is to be able to rely on such a characterization for the derivation of, or alignment to, existing eLearning frameworks for assessing the maturity of the framework. Furthermore, such a formal characterisation forms the basis for the construction of a taxonomy tree that shows relationships between and among eLearning frameworks.

A framework f is formally characterized as a triple $f(B, W, \alpha)$ where: B is the set of building blocks that make up the framework: $B = \{B_1, B_2, B_3, \dots, B_P\}$;W is the set of weights for each building block:$w = \left\{w_{B_1}, w_{B_2}, w_{B_3}, \dots, w_{B_p}\right\}$; and

α is as score function defined as follow:

$$BxW \rightarrow N$$

$$\alpha: (B_k, W_k)^P, k = 1 \dots P \rightarrow \frac{\sum_1^P w'_{B_k}}{\sum_1^P w_{B_k}}$$

Therefore,$\alpha[(B_k, W_k)^P] = s_f$ as previously defined.

The seven building blocks $\left(B_{k;k=1\dots7}\right)$ that form the basis of the proposed generic eLearning framework can be represented as follows: B_1(Institutional); B_2(Pedagogy); B_3(Culture); B_4(Technology); B_5(Management); B_6(Evaluation), and B_7(Ethics).

Figure 4-2 illustrates a generic eLearning framework consisting of the seven building blocks together with the metrics knowledge base. This metrics knowledge base contains guidelines, policies, standards, and regulations that can be used as a benchmark for evaluating the existing eLearning framework, as well as for cross-comparison purposes. Cross-comparison enables the institution to identify parts of the framework that require additional attention in order to achieve the desired level of maturity. In a real-life context, a dashboard of the current metrics of each component of the deployed framework would be maintained for the purpose of improving them as required to achieve the direction desired by the institution.

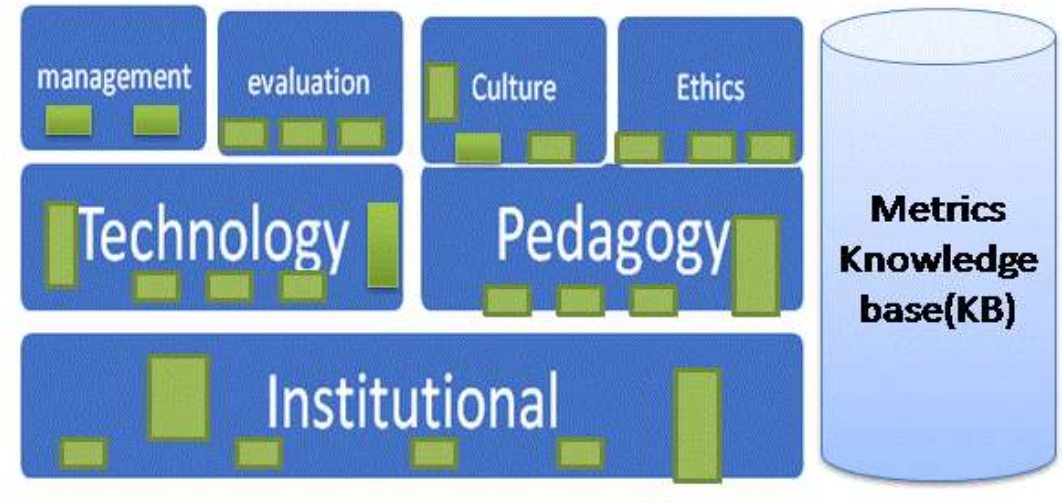

Figure 4-2.A Generic eLearning Framework

Based on this researcher's observation of the literature, there appears to be no systematic approach guiding the prioritization of the building blocks to be implemented by an institution. One eLearning framework developer may suggest that the institution building block should be implemented first, followed by the technology building block, thereafter, the pedagogy building block will follow, and so on. Another developer may recommend the concurrent implementation of building blocks, as opposed to a sequential approach. Building blocks may be implemented in any order, provided that there is a sound argument justifying the sequence. Nonetheless, in the majority of publications, including the research on a comprehensive blended learning framework, as described by Suhail and Mugisa, (2007), the institutional building block is considered to be the prime building block in the process of designing and implementing eLearning systems. This building block is important because it deals with a number of fundamental maters such as policy, training, budget, business, technical support, and infrastructure. As a result, it provides the sound foundation necessary for the successful implementation of an eLearning system. After implementing the institutional block, the other building blocks can be implemented in the order of priority as justified by the organisation.

The conceptual framework can also be used for alignment with an existing framework in order to look for areas for improvement at both a theoretical and practical level. Theoretically, the conceptual framework should be considered to be a foundational baseline.

4.4 Efficient Exploitation of the Generic eLearning Framework

As previously discussed, the suggested formalism of the generic eLearning framework forms the basis for exercises aimed at deriving, evaluating and adopting an eLearning framework. This section discusses how derivation and evaluation exercises can be undertaken.

4.4.1 Derivation of existing frameworks from the generic framework

- ***Introduction***

  This researcher believes that the formalised eLearning framework as has been described, is generic enough to cater for existing frameworks in the literature. Understandably, such a generic definition does not pretend to be absolute in the sense that more building blocks can be added to, or removed from, the framework as needed, without loss of generality. The formalism suggested in this work is intended to be able to perform a rigorous classification of eLearning frameworks that have similar features. Furthermore, this formalism can be used to derive new frameworks that can be further researched for improvement.

  The foundation of an eLearning framework is comprised of, for example, three building blocks, described mathematically, in order of priority, as $\left(B_{k;k=1\ldots3} = B_1; B_2; B_3\right)$; where B_1= Institutional; B_4= Technology; and B_2 = Pedagogy. The other four dimensions of the generic framework $\left(B_{k;k=4\ldots7}\right)$, while being important, might not necessarily form part of the framework to be implemented initially by an institution. The model suggests that building blocks can be implemented in various combinations, (B_1, B_2, B_3, B_4), (B_1, B_2, B_3, B_5), (B_1, B_3, B_7), etc. Each combination can be derived, aligned to existing ones in the literature, and studied in order to demonstrate scientifically, whether such a framework warrants consideration or not.

  For example, an investigation could be carried out to determine whether an eLearning framework consisting only of Institution, Technology, Pedagogy and Culture building blocks is effective enough to achieve an effective eLearning outcome and reasons behind such an assertion. Also, further investigation could also be made to demonstrate that the above combinations are related to, or are applicable to existing frameworks, or can be aligned to existing frameworks. This research now focuses on some examples derived from existing eLearning frameworks as described in the literature.

- ***Derivation of the Khan Framework***

  Khan's framework might be the derivation result of the generic formalism proposed in this chapter. As per the generic framework, Khan's framework consists of eight building blocks of which six can be accommodated in the formalism proposed in this chapter on a one-to-one basis. However, Khan's framework has two additional building blocks; namely interface design, and resources support that are not part of the generic formalism as a building block. This researcher believes that they should rather be considered as components of technology and pedagogy building blocks. This researcher is also of the opinion that interface design should not be regarded as a building block, but rather, it should be included as a component within the technology building block. Such a component, interface design, deals with the Human Computer Interaction (HCI) aspects of the technology building block, and it is for this reason that it should be considered to be a component within a building block, and not a building block in its own right.

  In the same vein, resource support can be regarded as a component that contributes to both the technology building block and the pedagogy building block. From a technology perspective, it deals with the various support mechanisms put in place by the institution, such as help desks and service level agreements (SLA). From a pedagogy perspective, the resource support component deals with supporting pedagogical instruments put in place by the institution to attend to various aspects of the learning life cycle, such as providing cognitive, emotional and moral support to learners whenever the need arises (Masoumi & Lindstrom, 2011). Similarly, blended multimedia-based eLearning framework, orbital e-education framework and comprehensive blended learning framework discussed in chapter 3 are eLearning frameworks that has building blocks similar to the building blocks of khan, though some of the building blocks are detailed in these three frameworks. For example, culture building block is separated from ethics building block for detailed analysis of culture in the case of blended multimedia-based eLearning framework. Hence the seven building blocks of the generic formalism are aligned with the seven building blocks of these frameworks in a one-to-one basis.

- **Derivation of the Theory-based model**

Theory-based model discussed in chapter 3 consists of two main building blocks namely: instructional and/or learning strategies, and pedagogical tools (online learning technologies).The generic formalism proposed in this chapter is generic enough and can accommodate two of the building blocks of theory-based framework. The pedagogy and technology building blocks of the generic formalism can be aligned with blocks of theory-based model in a one-to-one basis. Though the rest blocks of the generic formalism are missing directly in the target framework/model, they can also be aligned to these two building blocks. For example, ethics and culture can be aligned to both of the building blocks of this theory-based model since the essence of ethics, as well as culture is to generate relevant course content, and distribute it to every learner on an equal basis. Ethical content that is acceptable to each learner should be distributed through ethically and culturally accepted means (technology). Besides, without considering the language, economic and religious difference of learner as well as the academic crime issue such as plagiarism, which are all cultural and ethical issues, eLearning can't reach to its end. Similarly, management building block of the generic eLearning framework can also be aligned to the two building blocks of the theory-based model since management is key for both content development and distribution. Identifying the relevant content, and relevant media to distribute content, is the task of management; as is making sure course content is secured and is only available for authorized users.

The Evaluation building block can also be accommodated in the two building block of the theory based model since evaluating the learner for the subject matter and the learning environment, including evaluation of the effectiveness of the technological means, are unavoidable so as to come up with best eLearning implementation. It is the evaluation block that can check students' satisfaction level, cost effectiveness of the program, and the like, which are crucial for effective eLearning implementation. The same is also true for the institutional building block. Even though the institutional block is not incorporated in the theory based model, it is well understood that eLearning without this building block can't be effective. As it was surveyed from various literatures, for any eLearning to be effective, it needs institutional readiness; the academic, student and administrative matters should be ready so as to allow eLearning to run effectively. Institutional building block is

very crucial in that it provides staff training, library service, media service, registration service which are all the facilitators of eLearning process.

Hence considering the importance of all these blocks, it is advisable to accommodate them in the theory based model and also make them matured for effective eLearning implementation.

- **Derivation of the California eLearning Framework**

The California eLearning framework discussed in chapter 3, can be derived from the generic formalism and is made up of four focus areas: Content, technology, teaching and, operations. The pedagogy building block in the generic framework can be aligned to both content and teaching components of the California eLearning framework. In the same vein, the technology building block in the generic formalism can also be aligned to both technology and teaching components of the framework. The operations component of the California framework is also aligned to management and parts of the technology block of the generic eLearning model. The rest of the building blocks of the generic formalism can also be accommodated in the California framework. The evaluation block, for example, can best fit with teaching and operations. This is because, the evaluation block can check not only the effectiveness of the students' performance but also the teaching - learning process in general, including the performance of the management of the system. Similarly, the ethics and culture building blocks of the generic formalism can best fit the teaching, content and technology focus areas of the California framework. Teaching diverse groups of learners necessitate to consider the component ethics and culture. Preparation of course content as well as selection of teaching media (technology) are also influenced by culture and ethics. Content in eLearning should be understood by all groups of learners irrespective of their economic, social and political differences. This could be achieved by ensuring that cultural differences are considered. In addition, learner attitudes towards technology should be understood before launching an eLearning program for all groups of learners. Furthermore, equality of access to education for all should exist and this is taken care of in the ethics building block. The institutional building block in the generic formalism is not incorporated in the California framework, but it can be aligned to the teaching focus area, since the institution supports or facilitates the process of teaching and learning by providing training for instructors, preparing libraries, laboratories and the like.

To sum up, the attempt to incorporate all the building blocks that are mentioned important in the generic formalism for the specified existing framework, with the required maturity level should be given attention

- **Derivation of the Funnel Model**

  The Funnel model discussed in chapter 3 can be derived from the generic formalism and it incorporates three elements: Materials development and instructional design; technology and delivery; and governance and finance. These three elements can be directly aligned to the pedagogy, technology and institutional building blocks respectively, of the generic eLearning framework. The other four building blocks of the generic formalism are missing in the Funnel Model/framework. However, it is possible to align them with the generic framework, and thus get a promising result in the implementation of eLearning. The culture and ethics building blocks in the generic framework can be aligned to the materials development and technology elements of the Funnel Model/framework, because the development of ethical materials and means to deliver them are crucial for effective eLearning implementation. The evaluation building block of the generic framework is also important because it checks whether the developed material and the means of delivery are appropriate or not. Above all, the management building block of the generic framework can be aligned to all the three elements of the Funnel framework since it is the management block that provides assistant to all three elements. The management building block is expected to manage information flow from source to destination.

  All seven blocks of the generic eLearning framework are crucial, and therefore, should be incorporated into the Funnel Model for the successful implementation of eLearning.

- ***Derivation of the Demand Driven Learning Model(DDLM)***

  DDLM discussed in chapter 3 can be derived from the generic formalism suggested in this chapter, and consists of three essential components: quality content, distribution (delivery), and service. It focuses on learner needs, motivation, and convenience, through quality content, delivery, and service. In terms of the generic framework, pedagogy can directly be aligned to the superior quality content component of the DDLM framework. Similarly, the technology building block of the generic framework can be aligned to the delivery

component of this framework. Institutional building block, and some of the management building block, can aligned to service components of the DDLM framework. Although evaluation, culture and ethics building blocks of the generic framework are not directly incorporated in the DDLM framework, they can be aligned in the following ways: Evaluation building block of the formalism can be aligned to quality content and service; frequent evaluation of learners can be linked to quality content; quality content can also be tested by evaluating learners. Ongoing evaluation of the learning environment and how web-based learning services satisfy learners and educators is essential for the effective implementation of eLearning.

Culture and ethics building blocks can also be aligned to content and delivery. Academic learning content is considered to be of superior quality if it fulfils the diverse needs of discerning learners. This may be achieved if the cultural differences among learners are considered while preparing eLearning content. The selection of delivery media is also influenced by culture. It is the ethics building block of the generic framework that enables the delivery of content is a fair and just way.

Hence, so as to achieve effective eLearning implementation, the attempt to incorporate building blocks of the generic formalism to this existing eLearning framework should be given attention.

- ***Deriving the Adjunct eLearning Model from the Generic Framework***

In comparison with the generic eLearning framework that has seven building blocks: (institutional, pedagogy, culture, technology, management, evaluation, and ethics) the Adjunct eLearning Model, as discussed in chapter 3, is based on the traditional learning process with the addition of the capabilities of computer technology, to facilitate communication between learner and educator. The Adjunct eLearning model embraces elements of the technology and pedagogy building blocks of the generic eLearning framework. As such, it enables interactive communication, among learners, and between learners and educators, using basic tools such as email, chat, and messaging.

This model is technology-centric not learner-centric because it doesn't make use of a platform that can support learners online. However, it is the most common and widely used

eLearning model in the world irrespective of not addressing the motivation of learners and educators to use the model. It does not also emphasise how to manage cultural differences among learners and between learners and educators. In addition, ethical issues like copyright, and communication between groups are not given attention. Thus, though this model has some parts of the technology and pedagogy components, management, culture, ethics, evaluation and institutional building blocks of the generic eLearning framework are missing. As a result, this model is very limited as compared to the suggested generic eLearning framework. Any institution adopting this type of model would be expected to adopt it with the most basic maturity level required of the generic eLearning framework.

Firstly, the technology component should be matured and fully used. Technology should not only be used to transfer messages, it should be used to deliver courses, offer quizzes, and assessments to evaluate the learning and teaching process. Technology should be developed by considering cultural and learner differences, and with reference to the pedagogic principles for technology use. Second, course materials should be developed with reference to pedagogic principles for superior quality courses. Course content should be developed to achieve the required objectives of the course. The content should be understandable for all types of learners, and should allow the learner to participate in, and construct their own learning. Technology should allow for an interactive teaching and learning environment. After the technology and pedagogy components are matured, an institute should consider which of the other building blocks of the generic eLearning framework are relevant and important, and work to bring them up to the required level of maturity.

Other eLearning models include mixed, online, synchronous, asynchronous, computer-based training (CBT), internet-based training (IBT), web-based training (WBT), and web-based learning (WBL). While all of these models use technology, some are more technology-centric than others. All of these models have also pedagogy to some extent, with some models being more effective than others. Thus, two of the building blocks of the generic eLearning framework that are technology and pedagogy can be aligned to pedagogy and technology building blocks of these eLearning models. It can also be

concluded that two of the key building blocks are technology and pedagogy, and they should form the basis of any eLearning framework.

- ***Deriving the V-model of eLearning***

  The V-model discussed in chapter 3 have technology and pedagogy building blocks that can be derived from the generic eLearning framework. This model focuses on how electronic courses are conducted. The V-model focuses primarily on the pedagogical aspect of learning; technology, in terms of course delivery, is of secondary importance.

  Although this model focuses on pedagogy and embraces technology, it has limitations when compared to the requirements of the pedagogy and technology building blocks in the generic eLearning framework. The V-model doesn't consider pedagogy and technology in the course development process. Likewise, cultural differences and digital gaps among learners, and between learners and instructors are not given emphasis. The relevance of ethics in group communication and in dissemination of course content is also not given any attention. An institution that wishes to adapt this model, should focus on developing the maturity of pedagogy and technology building blocks. After that, the institution could work to incorporate other building blocks of the generic eLearning framework as necessary.

- ***Deriving the Hexa-C eLearning model***

  Similar to the V-model, this model emphasizes the preparation and delivery of eLearning courses, based on contemporary learning theory. It focuses on the pedagogical aspects of learning and also doesn't ignore technology as a means of course transfer. However, this model doesn't give priority to technology in the development of the e-course. Institutional issues, such as motivating users of the technology, providing training to fill skill gaps, and managing use of technology are not given direct attention. Cultural differences and digital gaps are not obvious, although these issues could be addressed in the customization element of this model. Evaluation of the overall system isn't given attention. Hence an institution that plans to adapt this framework/model should work on the maturity of the technology and pedagogy components with reference to the technology and pedagogy building blocks of the generic eLearning framework. After that, it should integrate other

components of the generic eLearning framework as necessary so as to address the limitations of the model.

4.4.2 Framework Maturity Assessment

In the advent that the proposed generic eLearning framework has already been adopted by a learning institution, its assessment for continuous improvement is important. The first step in improving the system is to establish the current level of maturity of the framework. This is done by analysing the metrics of the building blocks, components and elements that make up the eLearning framework. These metrics form part of the framework knowledge base (see figure 4-2). The scores relating to each element are evaluated, and the weighted score for each building block is then calculated. These weighted scores are then compared with the data in the knowledge base. This analysis forms the basis for drawing conclusions about which aspects of the framework need further improvement.

Table 4.8 provides an illustration for recording the performance metric (score) of the elements of a component. The weighted value of each element is calculated, and the overall weighted value of the component is obtained by averaging all weighted scores of the elements that make up the component.

Table 4-8: Component Evaluation based on elements' performance

		Evaluation	
Components	Weight	Score	Weighted
e_{j1}	$w_{e_{j1}}$	$s_{e_{j1}}$	$w_{e_{j1}} s_{e_{j1}}$
e_{j2}	$w_{e_{j2}}$	$s_{e_{j2}}$	$w_{e_{j2}} s_{e_{j2}}$
…	…	…	…
e_{jn}	$w_{e_{jn}}$	$s_{e_{jn}}$	$w_{e_{jn}} s_{e_{jn}}$
C_j	w_{c_j}	$\frac{\sum_1^n w_{e_{ji}} s_{e_{ji}}}{\sum_1^n w_{e_{ji}}}$	$w_{c_j} \frac{\sum_1^n w_{e_{ji}} s_{e_{ji}}}{\sum_1^n w_{e_{ji}}}$

Table 4.9 illustrates how the performance metrics of the components of a building block are recorded and calculated. The weight and score of each component (C_{K1}) is recorded. The weighted score for the component is then calculated. The overall weighted value of the building block (B_k) is obtained by averaging all weighted scores of the components that make up the building block

Table 4-9: Building block evaluation based on components' performance

		Evaluation	
Components	Weight	Score	Weighted
C_{K1}	$w_{c_{k1}}$	$S_{c_{k1}}$	$w_{e_{j1}} s_{e_{j1}}$
C_{K2}	$w_{c_{k2}}$	$S_{c_{k2}}$	$w_{e_{j2}} s_{e_{j2}}$
…	…	…	…
C_{km}	$w_{c_{km}}$	$S_{c_{kn}}$	$w_{e_{jn}} S_{e_{jn}}$
B_k	w_{B_k}	$\frac{\sum_{j=1}^{m} w_{c_{kj}} S_{c_{kj}}}{\sum_{j=1}^{m} w_{c_{kj}}}$	$w_{B_k} \frac{\sum_{j=1}^{m} w_{c_{kj}} s_{c_{kj}}}{\sum_{j=1}^{n} w_{c_{kj}}}$

The maturity of an eLearning framework is assessed as follows by using real life examples.

Let (B) represents an institution building block in a generic eLearning framework that has three components: administration affairs (C_1), academic affairs (C_2) and student affairs (C_3). Examples of metrics that form part of the knowledge base in the generic eLearning framework for the institution building block are illustrated in Table 4-10 below.

Table 4-10: Metrics to evaluate institution building block

Building block	Components	elements	Existing Metrics
Institution	administration affair (C_1)	policies (e_1)	The existence of policies
		information technology services (e_2)	Above 70% computer and internet(wireless) access by students
		payment and financial transaction services(e_3)	-The number of students who pay for the course. -The number of students who successfully pay for the registration process.
		admissions/registration services (e_4)	-The number of students who apply for a program -The number of students who are satisfied with the application process -The number of students who register for a program -The number of students who are satisfied with the registration process -The number of students who graduated
	academic affair (C_2)	Faculty and staff support (e_1) measured in number	-The number of staff and faculty members who took necessary skills gap training -Percentage of incentive for the teacher who will participate in the development of e-courses. -Percentage of copy right considerations -Percentage of financial support for faculty to conduct research, attend conferences and present papers in professional meetings
		instructional affairs(e_2) measured qualitatively	-Existence of information on faculty-to-student ratio -Percentage of academic quality of the e-courses -Existence of information about advising -Existence of information about workload
		Academic Computing Services(e_3) measured qualitatively	-Existence of managing application software and servers for courses -Existence of e-mail accounts, disk space for Web pages, technical support for students, faculty and staff.
	student affair (C_3)	orientation (e1) measured qualitatively	-Percentage of provided orientation about procedure of learning -Percentage of provided orientation about role and responsibilities of instructors and learners?
		Bookstore service (e2) measured qualitatively	Existence of bookstore service
		Library Support (e_3) measured qualitatively	Existence of library facilities in the eLearning system

		Financial Aid service(e_4) measured qualitatively	Percentage of Online financial aid workshops to assist students with both financial aid forms and other scholarship opportunities.
		Counseling service(e_5) measured qualitatively	Existence of counselling service in the eLearning system

Then, the building block B is represented as $B = \{C_1, C_2, C_3\}$. c_1 has also elements namely: policies(e_1) measured qualitatively, information technology services(e_2) measured in number (%),payment and financial transaction services (e_3) measured qualitatively, and admissions/registration services(e_4)measured in number (%).

Assume, the weight of each of the elements will be assigned in the following way relying on context of the institution and their degree of importance within the components: $W_{e_1} = 5(very\ high\ importance), W_{e_2} = 4(high\ importance), W_{e_3} = 2(low\ important), W_{e_4} = 3(medium\ importance)$

The scoring factor for each of the above element will be function of its measured value. If policy services do not exist; information technology services are 80% fulfilled; payment and financial transaction services are poorly achieved, and admissions/registration services are poorly achieved, the following scoring factor might be assigned for these elements.

$$e_1 = 0(Does\ not\ satisfay\ ), e_2 = 3(satisfay), e_3 = 2(partily\ satisfay), e_4 = 3$$

The scoring factor of the component will then be

$$S_{c_1} = \frac{\sum_i^4 W'_{e_i}}{\sum_1^4 W_{e_i}} = \frac{\sum_1^4 W_{e_i} s_{e_i}}{\sum_1^4 W_{e_i}} = \frac{(5X0)+(4X3)+(2X2)+(3X3)}{5+4+2+3} = \frac{12+4+9}{14} = \frac{25}{14} = 1.78$$

It is also assumed that the administration affair component is part of a group of components such as academic affair and student affair and has a weight of 3(medium importance) within that group based on the context of the institutions. Its weighted score will then be:

$$W'_{c_1} = W_c S_c = 3 \times 1.78 = 5.34$$

The calculation of weighted score for the other components will follow. The next component academic affair (C_2) has elements namely faculty and staff support (e_1) measured in number (%),instructional affairs(e_2) measured qualitatively, Academic Computing Services(e_3) measured qualitatively.

Assume, the weight of each of the elements will be assigned in the following way relying on context of the institution and their degree of importance within the components: $W_{e_1} = 5(very\ high\ importance), W_{e_2} = 3(medium\ importance), W_{e_3} = 4(high\ important)$

The scoring factor for the elements of the academic affair component will be function of its measured value. If faculty and staff support services are done 40%; instructional affair services are somehow fulfilled; Academic Computing Services are to some extent achieved, the following scoring factor might be assigned.

$$e_1 = 2(partily\ satisfay\ ), e_2 = 2(partily\ satisfay), e_3 = 3(\ satisfay)$$

The scoring factor of the component will then be

$$S_{c_2} = \frac{\sum_i^3 W'_{e_i}}{\sum_1^3 W_{e_i}} = \frac{\sum_1^3 W_{e_i} s_{e_i}}{\sum_1^3 W_{e_i}} = \frac{(5X2)+(3X2)+(4X3)}{5+3+4} = \frac{10+6+12}{12} = \frac{28}{12} = 2.3$$

It is also assumed that the academic affair component is part of a group of components such as administration affair and student affair and has a weight of 4(medium importance) within that group based on the context of the institutions. Its weighted score will then be:

$$W'_{c_2} = W_c S_c = 4 \times 2.3 = 9.3$$

The third component of the institution building block is student affair (C_3) that has elements namely orientation (e_1) measured in number (%), Bookstore service (e_2) measured qualitatively, Library Support(e_3) measured qualitatively, Financial Aid service(e_4) measured in number (%)and Counseling service(e_5) measured qualitatively.

Assume, the weight of each of the elements will be assigned in the following way relying on context of the institution and their degree of importance within the components: $W_{e_1} = 4(\ high\ importance), W_{e_2} = 3(medium\ importance), W_{e_3} = 5(very\ high\ importance), W_{e_4} = 2(low\ important), W_{e_5} = 1(very\ low\ important)$

The scoring factor for each of the above element will be function of its measured value. If orientation services are done 40%; Bookstore services are not good; library are very poorly achieved; Financial Aid service are not incorporated and counseling service is not incorporated, the following scoring factor might be assigned for the above elements.

$$e_1 = 2(partily\ satisfay\ ), e_2 = 0(doesn't\ satisfay), e_3 = 0(\ doesn'tsatisfay), e_{4=}1(weakly\ satisfay) and\ e_{5=}0(doesn't\ satisfay)$$

The scoring factor of the component will then be

$S_{c_3} = \frac{\sum_i^5 W'_{e_i}}{\sum_1^5 W_{e_i}} = \frac{\sum_1^5 W_{e_i} s_{e_i}}{\sum_1^5 W_{e_i}} = \frac{(4X2)+(3X0)+(5X0)+(2X1)+(1X0)}{4+3+5+2+1} = \frac{8+0+0+2+0}{15} = \frac{10}{15} = 0.66$ The student affair component is also part of a group of components such as administration affair and academic affair and has a weight of 5(very high importance) within that group based on the context of the institutions. Its weighted score will then be:

$$W'_{c_3} = W_c S_c = 5 \times 0.66 = 3.3$$

Let w_B be the weight of the building block $\mathcal{B}$

The scoring factor of $\mathcal{B}$ denoted $s_{\mathcal{B}}$ is obtained by dividing the sum of all components' weighted score by the sum of all components' weight within that building block

$$s_{\mathcal{B}} = \frac{\sum_1^m w'_{C_j}}{\sum_1^m w_{C_j}} = \frac{\sum_1^m w_{C_j} s_{C_j}}{\sum_1^m w_{C_j}}$$

$$S_{B=} \left(\frac{3.3 + 9.3 + 5.34}{5 + 4 + 3}\right) = \frac{17.94}{12} = 1.495$$

The weighted score of the building block will then be:

$$W'_{\mathcal{B}} = W_{\mathcal{B}} S_{\mathcal{B}} = W_{\mathcal{B}} \frac{\sum_1^m W_{C_j} S_{C_j}}{\sum_1^m W_{C_j}}$$

The institution building block is also part of a larger group such as pedagogy, culture, technology…Then, the weight of this is assumed as 5(very high importance).

$$W'_{B_1} = 5 \times 1.495 = 7.475$$

The calculation of weighted score for the other building blocks will continue in the same manner. Then, score factor of the framework as a whole will be calculated using the formula below and ultimately maturity of the framework will be determined. As it is mentioned in the preliminary section, a framework would be considered matured when it consists of all required building blocks achieving higher scoring factors.

$$S_f = \frac{\sum_1^p W'_{B_k}}{\sum_1^p W_{B_k}} = \frac{\sum_1^p W_{B_k} S_{B_k}}{\sum_1^p W_{B_k}} = \left(\frac{\sum_{k=1}^p W_{B_k} \left(\sum_{j=1}^m W_{c_{kj}} S_{c_{kj}} / \sum_{j=1}^m W_{c_{kj}}\right)}{\sum_{k=1}^p W_{B_k}}\right)$$

The result obtained from informs on the maturity level by mapping the score factor to the maturity index. Therefore,

$$S_f = i \rightarrow L_i; i \in (0,5]$$

The Maturity M_f of the framework will be optimized or the highest if the score factor of the framework is the highest as compared to the predetermined threshold level.

The calculated score factor for each building block in the framework can be compared against metrics in the knowledge base, as well as against best practice results. This analysis will form the basis for determining the overall maturity of the framework as well as identifying areas for improvement at building block, component and element level. The remedial actions that will be taken aimed at ensuring that the framework tends towards a full conformance to best practice.

4.5 A Proposed Generic Methodology for eLearning Adoption

As previously stated, the result of the rapid expansion of the internet has enabled eLearning to become possible. eLearning as a learning approach has made teaching and learning better and easier by leveraging information technology (IT) tools in education, and training manpower with the goal of decreasing movement, time, and expense. (Nejad, Nejad & Sadeghijoola, 2012). The effect on higher education is that since eLearning enables students to receive an education despite a distant physical setting HE institutions are expected to be networked and connected as the globalisation of the education sector has brought about fundamental changes (Suhail and Mugisa, 2007). While the current literature emphasises that the growth of eLearning is occurring in countries with advanced economies, there is an even greater need in developing countries. A country like Ethiopia can make use of eLearning to solve problems related to shortage of teachers, untrained teachers, poor English language, and inadequate resources. Developing countries can use eLearning to prepare their human capital with the abilities needed for today's knowledge society. As a result, there is wide spread adoption of eLearning throughout the world. However, there is lack of scientific mechanism that shows relationship between/among plethora of eLearning frameworks that are developed by the interest of different vendors. This again can be a factor to inhibit adoption of eLearning based on existing frameworks. It is strongly argued that whilst the integration of eLearning in tertiary education is exceptionally beneficial and significant, the benefits can only be realised if the technology is successfully adopted and utilized (Mbengo, 2014).

Unfortunately, despite the benefits of eLearning, Ethiopia has failed to adequately deploy eLearning in higher education, because of weak infrastructure development, support, and pedagogical issues (Elgort, 2015; Pakiso Joseph Khomokhoana and Scientiae, 2011). A plausible explanation for this challenge may be attributed to the fact that institutions are adopting eLearning without the required rigorous maturity assessment. As a result, it seems reasonable to initiate a research study that proposes a methodology for eLearning framework adoption to guide the process.

The proposed methodology depicted in the Figure 4-3 below, could be helpful in assisting institutions in the whole eLearning adoption process, including preparation, implementation and improvement. Prior to adopting an eLearning framework, an institution should consider creating an awareness of eLearning, establishing the necessary infrastructure, and developing policies and curriculum. This essential preparatory work is included in the suggested methodology. During the implementation phase of the eLearning adoption process, issues of infrastructure and system management, training and technical support, and so on, need to be addressed. The post adoption process addresses the evaluation of the system as a whole.

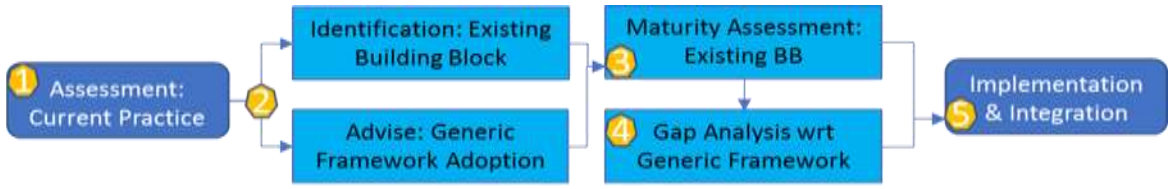

Figure 4-3.Steps of eLearning adoption

The generic eLearning framework proposed in this chapter provides a base to develop a step-wise approach to eLearning adoption while maintaining the required standards for achieving the desired level of maturity. The steps proposed in the eLearning adoption methodology are discussed below.

4.5.1 Assessment

The first step in the process is the assessment of the institutions' current eLearning practice, and is aimed at determining whether the institution has started to implement eLearning or not. The deliverable of this step is the production of information about the status of current eLearning practice. This information will help an institution make relevant decisions on how to start, boost, or improve the performance of eLearning practice.

4.5.2 Identification of existing building blocks/Advice on adoption of the generic framework

If the institution has already started eLearning, this step involves identifying the basic building blocks of the existing framework. If the institution has not yet started implementation, this step provides advice to the institution about how to adopt the generic eLearning framework as suggested in this study from scratch. The deliverables of this step include an analysis of existing building blocks and mapping them to the generic framework; or alternatively, the provision of advice and guidance on how to adopt they generic eLearning framework in its entirety. This step helps an institution to assess the status of their existing building blocks and whether they need improving, or changing.

4.5.3 Maturity assessment

The third step in the adoption process is maturity assessment of the existing eLearning framework. Maturity assessment means checking whether the technology component is up to the standard required. This includes determining to what extent the hardware and software components required for eLearning have been met, and to what extent technical support and training is provided to users of the system, including learners, instructors and teachers. The maturity of the institutional and other building blocks are also assessed.

4.5.4 Gap analysis

Identifying and analysing gaps between the existing eLearning framework and the generic framework is the fourth step. The two frameworks are compared and any gaps are recorded. The deliverable produced by this step are identified gaps or problems that exist in the current as compared with the generic framework. This analysis helps an institution to make decisions on where and how to improve the existing system.

4.5.5 Implementation and integration

The final step is the integration of the existing building blocks into the generic eLearning framework, as well as the implementation of new building blocks. If the existing eLearning systems lack some building blocks of the generic framework, and if it is believed they are necessary, these building blocks should be integrated with the existing system. The focus of this step is to solve problems identified in the gap analysis, as well, as the integration of new building blocks with existing building blocks to produce a workable eLearning system.

Having such a methodical guideline in place will help an institution wishing to adopt eLearning follow a rigorous adoption process. The steps are summarised as follows:

- Assessment of the current eLearning practice,
- Identification of existing building blocks or the giving of advice to how to adopt the generic framework,
- Maturity assessment of the existing eLearning framework,
- Gap-Analysis with respect to the generic framework, and
- Implementation and integration new building blocks to the eLearning framework.

4.5.6 Methodology: Wollo University Case Study

Wollo University (WU) is used as a case study to illustrate how the generic eLearning framework and methodology can be applied in a real-life context. Wollo University was founded in 2005 E.C. and is one of Ethiopia's second-generation federal universities. The institution is located in the Amhara State's South Wollo Zone, in the heart of a territory rich in archaeological, anthropological, and historical discoveries, as well as numerous ethnic and religious groups noted for their peaceful coexistence. It was established with the mission of undertaking teaching, learning and research, as well as community service. The teaching and learning component consists of various departments and administrative units that work together to generate quality graduates. Currently, the university offers degrees up to PhD level. There are 15 928 regular students enrolled (40.3 percent of whom are women), with 826 regular postgraduates (17.43 percent are women). The Directorate for Continuing and Distance Education of the Wollo University is one of the main providers of continuing education in Ethiopia's Amhara Regional State. It provides summer, extension, and distance education to over 12 237 undergraduate and graduate students, ranging from certifications and diplomas to master's degrees. A pilot study was conducted at the university for the purpose of applying this researcher's conceptual methodology for eLearning adoption, and thereby establishing the applicability of this methodology in a real-life context. A detailed structured interview questionnaire, compiled for the purpose of the pilot study can be seen in Appendix C. The questionnaire targeting five expert respondents: Two administrators, and three instructors, was administered. In addition, observation, using the observation checklist attached in Appendix F, was also done so as to ensure thorough data collection and analysis. The questionnaire was crafted to address each phase of this researcher's proposed methodology, and address the

intended objectives of that phase. The step-by-step application of the methodology at the university is described in the sections that follow:

- ***Step 1: Assessment of the current eLearning practice at WU:***

  The first step of the conceptual eLearning framework aims at establishing whether there is any form of eLearning practice within the institution or not. If such a practice exists, the extent of the practice is determined by identifying existing building blocks.

  Analysis of data collected from this researcher's pilot study at WU suggested that the institution is only at the preparation phase of the adoption and implementation of eLearning. The University also foresees eLearning as an important strategic driver necessary for future growth and advancement.

- ***Step 2.1: Identification of existing eLearning building blocks.***

  Although the evidence indicated that eLearning practice was not yet effective at WU because it was still at an early preparation stage, the university had started developing some of the building blocks that this researcher believes form part of the fundamentals required for the adoption of eLearning. The focus of this researcher's investigation was to identify what building blocks were being implemented, and to discover what additional blocks were being considered by the university in the future, as part of the eLearning implementation process.

  This researcher's investigation identified three building blocks as being part of the current eLearning educational practice at WU: the institutional building block; the technology building block, and the pedagogy building block. The university confirmed that those building blocks will be considered in the process of implementing eLearning. However, the university's priority is to strengthen the technology infrastructure by establishing data centres, smart classes and sustainable internet connections.

- ***Step 2.2: Advice on the generic framework adoption***

  Having determined that the university currently had three building blocks that were all aligned to those of the generic eLearning framework, it was possible to advise the institution on how to adopt the framework. Out of the seven building blocks that made up

the generic eLearning framework (as described in section 4-3), the university already had three building blocks: Institutional, Technology and Pedagogy, but lacked the remaining four building blocks: Management, Ethics, Culture, and Evaluation. It could be argued that building blocks not identified during this researcher's assessment, could implicitly exist at the university by virtue of having significantly low maturity. Nevertheless, this researcher was now at a position to conjecture that those unidentified building blocks, being of negligible maturity, were candidates for adoption and implementation in the future. In the same vein, those building blocks that existed, should be subjected to a quantified maturity assessment, as required by the next step of the generic eLearning methodology.

- ***Step 3: Maturity assessment of the existing eLearning building blocks***

  The maturity levels of three building blocks currently being implemented at WU: Institutional, technology and pedagogy, were assessed using the methodology to calculate the scoring factor as discussed, and demonstrated, in section 4.4.2

Let B be a set of all building blocks that make up a framework f of Wollo University. The maturity of (f) denoted by (M_f) is obtained by first calculating the scoring factor of the framework and mapping the result to the relevant maturity level. The scoring factor of the framework (S_{Ff}) is calculated from the following formula:

$S_F = \frac{\sum_1^p W'_{B_k}}{\sum_1^p W_{B_k}} = \frac{\sum_1^p w_{B_k} S_{B_k}}{\sum_1^p W_{B_k}} = \left(\frac{\sum_{k=1}^p W_{B_k} \left(\sum_{j=1}^m w_{c_{kj}} s_{c_{kj}} / \sum_{j=1}^m w_{c_{kj}} \right)}{\sum_{k=1}^p w_{B_k}} \right)$ Where all variables are as described in section 4.2.1.6

Having established that only 3 building blocks will be considered in our calculation out of the 7, it will be assumed that the weight and the weighted score of unexciting building blocks are negligible in the calculation because the university is yet to implement those building blocks explicitly.

Our scoring factor formula then becomes:

$$S_F = \frac{\sum_1^3 W'_{B_k}}{\sum_1^3 W_{B_k}} = \frac{\sum_1^3 w_{B_k} S_{B_k}}{\sum_1^3 W_{B_k}} = \left(\frac{\sum_{k=1}^3 W_{B_k} \left(\sum_{j=1}^m w_{c_{kj}} s_{c_{kj}} / \sum_{j=1}^m w_{c_{kj}} \right)}{\sum_{k=1}^3 w_{B_k}} \right)$$

Values for each building block is calculated as follow:

- **Institution building block: $\mathbf{B_1}$**

This building block consists of three components: Administration (C_{11}), Academic Affairs (C_{12}), and Student Affairs (C_{13}).

The administration component has five elements: Admissions (e_{111}), Finance (e_{112}), Payment (e_{113}), IT Services (e_{114}), and Policies (e_{115}).

The academic affairs component has three elements: staff support (e_{121}), instructional affairs (e_{122}), academic computing services (e_{123}).

The student affairs component has three elements: orientation (e_{131}), book store (e_{132}), library support (e_{133}).

The current pilot assessment in WU revealed that the institution building block is of very high importance to the institution. As such, its weight can be attributed to the value 5 ($W_{B_1} = 5$). Furthermore, the assessment revealed that the respective weigh of each component on the building block are as follows: administration $W_{C_{11}} = 3$; academic affairs$W_{C_{12}} = 5$; student affairs$W_{C_{13}} = 4$;

For the various elements of each components the following weight were revealed by the assessment:

$W_{e_{111}} = 3$; $W_{e_{112}} = 2$; $W_{e_{113}} = 1$; $W_{e_{114}} = 4$; $W_{e_{115}} = 5$ (elements in C_{11} , Administration)

$W_{e_{121}} = 5$; $W_{e_{122}} = 3$; $W_{e_{123}} = 4$ (elements in C_{12}; Academic Affairs)

$W_{e_{131}} = 3$; $W_{e_{132}} = 4$; $W_{e_{133}} = 5$ (elements in C_{13}; Student affairs)

The following scoring factors were also collected for all the above elements during the pilot study.

$S_{e_{111}} = 0$; $S_{e_{112}} = 1$; $S_{e_{113}} = 0$; $S_{e_{114}} = 4$; $S_{e_{115}} = 0$ (elements in C_{11} , Administration)

$S_{e_{121}} = 0$; $S_{e_{122}} = 0$; $S_{e_{123}} = 0$ (elements in C_{12}; Academic Affairs)

$S_{e_{131}} = 0$; $S_{e_{132}} = 0$; $S_{e_{133}} = 0$ (elements in C_{13}; Student affairs)

Finally, the scoring factor of the institution building block is obtained as follow:

$$S_{B_1} = \frac{\sum_1^3 W'_{C_{1k}}}{\sum_1^3 W_{C_{1k}}} = \frac{\sum_1^3 W_{C_{1k}} S_{C_{1k}}}{\sum_1^3 W_{C_{1k}}} = \left(\frac{W_{C_{11}} S_{C_{11}} + W_{C_{12}} S_{C_{12}} + W_{C_{13}} S_{C_{13}}}{W_{C_{11}} + W_{C_{12}} + W_{C_{13}}}\right)$$

$$= \left(\frac{W_{C_{11}} \left(\sum_{j=1}^5 W_{e_{11j}} S_{e_{11j}}\right) \Big/ \sum_{j=1}^5 W_{e_{11j}} + W_{C_{12}} \left(\sum_{j=1}^3 W_{e_{12j}} S_{e_{12j}}\right) \Big/ \sum_{j=1}^3 W_{e_{12j}} + W_{C_{13}} \left(\sum_{j=1}^3 W_{e_{13j}} S_{e_{13j}}\right) \Big/ \sum_{j=1}^3 W_{e_{13j}}}{W_{C_{11}} + W_{C_{12}} + W_{C_{13}}}\right)$$

$$= \left(\frac{W_{C_{11}} \left(W_{e_{111}} S_{e_{111}} + W_{e_{112}} S_{e_{112}} + W_{e_{113}} S_{e_{113}} + W_{e_{114}} S_{e_{114}} + W_{e_{115}} S_{e_{115}}\right) \Big/ 15 + W_{C_{12}} \left(W_{e_{121}} S_{e_{121}} + W_{e_{122}} S_{e_{122}} + W_{e_{123}} S_{e_{123}}\right) \Big/ 12}{W_{C_{11}} + W_{C_{12}} + W_{C_{13}}}\right)$$

$$= \left(\frac{0.2(18) + 0.42(0) + 0.33(0)}{3 + 5 + 4}\right) = \left(\frac{3.6 + 0 + 0}{3 + 5 + 4}\right) = \left(\frac{3.6}{3 + 5 + 4}\right) = \left(\frac{3.6}{12}\right) = 0.3$$

It follows from the above that the weighted score for this building block is:

$$W'_{B_1} = W_{B_1} S_{B_1} = 5 \; X \; 0.3 = 1.5$$

Technology building block : B_2

This building block consists of two components: Infrastructures and resources (C_{21}), Interface and design (C_{22}).

The infrastructures and resources component has five elements: personnel (e_{211}), budgeting (e_{212}), hardware (e_{213}), software (e_{214}), and technical support (e_{215}).

The interface and design component has three elements: aesthetic (e_{221}), design (e_{222}), usability (e_{223}).

The pilot assessment revealed that the technology building block is of high importance to the institution. As such, its weight can be attributed the value 4 ($W_{B_2} = 4$). Furthermore, the assessment revealed that the respective weighs of each component on the building block are as follows: infrastructure and resources$W_{C_{21}} = 5$; interface and design $W_{C_{22}} = 4$.

For the various elements of each components the following weight were revealed by the assessment:

$W_{e_{211}} = 3$; $W_{e_{212}} = 1$; $W_{e_{213}} = 5$; $W_{e_{214}} = 4$; $W_{e_{215}} = 2$ (elements in C_{21})

$W_{e_{221}} = 4$; $W_{e_{222}} = 5$; $W_{e_{223}} = 3$ (elements in C_{22})

The following scoring factors were also collected for all the above elements during our pilot study.

$S_{e_{211}} = 3$; $S_{e_{212}} = 1$; $S_{e_{213}} = 4$; $S_{e_{214}} = 4$; $S_{e_{215}} = 1$ (elements in C_{21})

$S_{e_{221}} = 0$; $S_{e_{222}} = 0$; $S_{e_{223}} = 0$ (elements in C_{22})

Finally, the scoring factor of the technology building block is obtained as follow:

$$S_{B2} = \frac{\sum_1^2 W'_{C_{2k}}}{\sum_1^2 W_{C_{2k}}} = \frac{\sum_1^2 W_{C_{2k}} S_{C_{2k}}}{\sum_1^2 W_{C_{2k}}} = \left(\frac{W_{C_{21}} S_{C_{21}} + W_{C_{22}} S_{C_{22}}}{W_{C_{21}} + W_{C_{22}}}\right) =$$

$$\left(\frac{W_{C_{21}} \left(\sum_{j=1}^5 W_{e_{21j}} S_{e_{21j}}\right) \Big/ \sum_{j=1}^5 W_{e_{21j}} + W_{C_{22}} \left(\sum_{j=1}^3 W_{e_{22j}} S_{e_{22j}}\right) \Big/ \sum_{j=1}^3 W_{e_{22j}}}{W_{C_{21}} + W_{C_{22}}}\right) =$$

$$\left(\frac{W_{C_{21}} \left(W_{e_{211}} S_{e_{211}} + W_{e_{212}} S_{e_{212}} + W_{e_{213}} S_{e_{213}} + W_{e_{214}} S_{e_{214}} + W_{e_{215}} S_{e_{215}}\right) \Big/ 15 + W_{C_{22}} \left(W_{e_{221}} S_{e_{221}} + W_{e_{222}} S_{e_{222}} + W_{e_{223}} S_{e_{223}}\right) \Big/ 12}{W_{C_{21}} + W_{C_{22}}}\right) =$$

$$\left(\frac{0.33(3X3+1X1+5X4+4X4+2X1) + 0.33(4X0+5X0+3X0)}{5+4}\right) = \left(\frac{0.33(9+1+20+16+2) + 0.33(0)}{5+4}\right) =$$

$$\left(\frac{0.33X53 + 0.33X0}{5+4}\right) = \left(\frac{15.84+0}{9}\right) = \frac{17.49}{9} = 1.94$$

It follows form the above that the weighted score for this building block is:

$$W'_{B_2} = W_{B_2} S_{B_2} = 4\ X\ 1.94 = 7.04$$

- **Pedagogy building block: B_3**

This building block consists of two components content (C_{31}), methods (C_{32}).The content component has three elements: Goal clarity (e_{311}), content clarity (e_{312}), organization of course (e_{313}).

The methods component has four elements: Design approach (e_{321}), Methods and strategies (e_{322}), Medium of eLearning environment (e_{323}), Human resource support (e_{324}).

The pilot assessment revealed that the Pedagogy building block has the rank importance to the university. As such, its weight can be attributed the value 3 ($W_{B_3} = 3$). Furthermore, the assessment revealed that the respective weighs of each component on the building block are as follows: content$W_{C_{31}} = 5$; methods$W_{C_{32}} = 4$.

For the various elements of each components the following weight were revealed by the assessment:

$W_{e_{311}} = 5$; $W_{e_{312}} = 4$; $W_{e_{313}} = 3$ (elements in C_{31})

$W_{e_{321}} = 2; W_{e_{322}} = 3; W_{e_{323}} = 1;\ W_{e_{324}} = 0$(elements in C_{32})

The following scoring factors were also collected for all the above elements during the pilot study.

$S_{e_{311}} = 3; S_{e_{312}} = 3; S_{e_{313}} = 0$ (elements in C_{31})

$S_{e_{321}} = 1; S_{e_{322}} = 0; S_{e_{323}} = 0;\ S_{e_{324}} = 0$(elements in C_{32})

Finally, the scoring factor of the Pedagogy building block is obtained as follow:

$$S_{B3} = \frac{\sum_1^2 W'_{C_{3k}}}{\sum_1^2 W_{C_{3k}}} = \frac{\sum_1^2 W_{C_{3k}} S_{C_{3k}}}{\sum_1^2 W_{C_{3k}}} = \left(\frac{W_{C_{31}} S_{C_{31}} + W_{C_{32}} S_{C_{32}}}{W_{C_{31}} + W_{C_{32}}}\right) =$$

$$\left(\frac{W_{C_{31}} \left(\sum_{j=1}^3 W_{e_{31j}} S_{e_{31j}}\right) \Big/ \sum_{j=1}^3 W_{e_{31j}} + W_{C_{32}} \left(\sum_{j=1}^4 W_{e_{32j}} S_{e_{32j}}\right) \Big/ \sum_{j=1}^4 W_{e_{32j}}}{W_{C_{31}} + W_{C_{32}}}\right) =$$

$$\left(\frac{W_{C_{31}} \left(W_{e_{311}} S_{e_{311}} + W_{e_{312}} S_{e_{312}} + W_{e_{313}} S_{e_{313}}\right) \Big/ 12 + W_{C_{32}} \left(W_{e_{321}} S_{e_{321}} + W_{e_{322}} S_{e_{322}} + W_{e_{323}} S_{e_{323}} + W_{e_{324}} S_{e_{324}}\right) \Big/ 6}{W_{C_{21}} + W_{C_{22}}}\right) =$$

$$\left(\frac{0.42(5X3+4X3+3X0) + 0.67(2X1+3X0+1X0+0)}{5+4}\right) = \left(\frac{0.42(15+12+0) + 0.67(2+0+0+0)}{5+4}\right) = \left(\frac{0.42X27 + 0.67X2}{5+4}\right) =$$

$$\left(\frac{11.34+1.33}{9}\right) = \frac{12.67}{9} = 1.40$$

It follows from the above that the weighted score for this building block is:

$$W'_{B_3} = W_{B_3} S_{B_3} = 3\ X\ 1.40 = 4.2$$

Having calculated the maturity of each building block, It is finally obtained the scoring factor of the framework as follow:

$$S_F = \frac{\sum_1^3 W'_{B_k}}{\sum_1^3 W_{B_k}} = \left(\frac{W'_{B_1} + W'_{B_2} + W'_{B_3}}{W_{B_1} + W_{B_2} + W_{B_3}}\right) = \left(\frac{1.5 + 7.04 + 4.2}{5 + 4 + 3}\right) = 1.06$$

The scoring factor of the framework for the WU is thus at 1.06, suggesting that the maturity of the framework falls between poor and basic as per our maturity scheme discussed in section 4.2.1.6, that is between Level 1 and Level 2.

The result clearly suggests that the university remains at a very low level of maturity. But this can clearly be justified by the fact that only three building blocks were considered in this pilot study as the other building block where not discovered during our investigation.

4.5.6.1 Step 4: Gap Analysis

In this step, based on the outcome of the assessment, a gap assessment should be conducted.

The following gaps have been identified:

- Gap on existing building blocks: there is a need to significantly improve the maturity of the three building blocks (institution, technology and pedagogy) by the way of analysing the outcome of the pilot conducted and identifying areas of improvement in order to move from the current maturity to a desired higher level maturity. During the gap analysis phase, it is observed that the score factor of the building blocks institution, pedagogy and technology are 0.3, 1.39 and 1.96 respectively which shows the maturity level of very poor to basic. In WU, in order to improve the framework's overall maturity, the score factor of each building block, component, and then element should be improved to at least level two. In order to improve the maturity level of the institution building block, WU is expected to plan so as to give necessary training for eLearning users, to allocate budget for eLearning purpose and to give incentive and funds for usage of eLearning, research work and conferences. WU is also expected to arrange a program that can enhance motivation of eLearning users. Above all, WU should work hard in integrating library and book store services as well as registration and application services with its eLearning system. Similarly, so as to improve the maturity level of the technology building block, student-computer ratio should be enhanced, sustainable power and internet connection should be there, as well as eLearning portal with user friendly interface should be there. In addition, dedicated technical support should be there. The maturity level of the pedagogy building block can be increased by arranging a course development program that is pedagogically guided.
- Inherent Gap: Inherent gaps pertains to the lack of the 4 building blocks namely culture, ethics, evaluation and management that were not identified during the assessment phase. These four building blocks are suggested as building blocks of the generic eLearning framework developed in this chapter. They are of importance for the improvement of the maturity of the eLearning framework in WU in order to support the university's journey for eLearning adoption and implementation. Since our current assessment reveals that these building have not been implemented at all, the university should consider putting in place

a strategy for implementing them equally as the strategy aimed at improving existing blocks.

4.5.6.2 Step 5: Implementation and Integration

In this step, in order for WU to implement successful eLearning, all the building block of the generic eLearning framework with very good maturity level should be given attention. To this end, a formal engagement should be made with the university in order to close the identified gaps by initiating a project defining the scope, establishing a project plan then tracking of progress and deliverables.

4.6 Chapter Conclusion

In this chapter, the research objective ***Develop a generic eLearning framework (GeF) and a methodology for eLearning framework adoption was*** achieved. A number of steps were taken to construct the framework, including an analysis of the large number of existing eLearning frameworks and models outlined in chapter three. The commonalities and differences of existing frameworks were identified; basic and common features (building blocks) of the frameworks were also identified. Then, an eLearning framework consists of seven building blocks namely: institution, technology, pedagogy, management, evaluation, ethics and culture was proposed as a generic eLearning framework. Then, a methodology for eLearning adoption was proposed. This methodology is a step-wise approach that can guide eLearning adoption in higher learning institutions. The chapter also discussed five of the steps namely: Assessment of the current eLearning practice, identifying existing building blocks if there exists or advised institutions to adopt the generic eLearning framework from the scratch, assessment of the maturity level of the practice and gap-analysis and finally, implementation and integration with the new building blocks of the generic framework.

The chapter also concluded with the demonstration of a methodology for eLearning adoption in the case of WU.

The generic eLearning framework proposed in this chapter is also a foundation for chapter 5 that will discuss the taxonomy development which can assist classification and show relationship of a plethora of eLearning frameworks.

5 CHAPTER FIVE: TAXONOMY DEVELOPMENT

5.1 Introduction

In the earlier section, a generic eLearning framework was proposed. It consists of building blocks of which characterisations were discussed. A methodology for eLearning adoption by learning institutions was also presented. Because of the importance of eLearning in education, a large number of eLearning frameworks have been developed and made available in the literature. This makes the selection and implementation of an eLearning framework challenging to institutions because there are so many to choose from. As a result, the classification or taxonomy of eLearning frameworks becomes relevant for the purpose of simplifying the process of choosing, and implementation, of eLearning frameworks by learning institutions.

The aim of this chapter is to deliver a classification of eLearning frameworks by developing a taxonomy tree based on the generic framework developed in the previous chapter. This goal will be accomplished by responding to the following research question. How is a taxonomy of eLearning frameworks developed? By answering the question, this researcher hopes to contribute to the available literature with a simplified eLearning framework classification scheme that demonstrates the relationships between frameworks on a taxonomy tree. This representation will go a long way in assisting learning institutions to identify their maturity level from a framework adoption perspective, and so discover the magnitude of what improvements are required to achieve a target maturity.

The remaining part of this chapter has been organised as follows: an overview of taxonomy, history, definition, type, methods, attributes, as well as approach to taxonomy development in the field of information systems, will be covered in section 5.2. An approach to the generic construction of a taxonomy tree, as well as its use in a real-life context will be discussed in sections 5.3. A summary and conclusion follow in section 5.4.

5.2 Overview of Taxonomy and Taxonomy development

5.2.1 History of taxonomy

The classification of information and knowledge is not new and has been happening for many years. A library in Egypt established one of the earliest big organized catalogues. It was a 120-volume subject catalogue of all the library's volumes, complete with author names, text data, and authenticity notes to assist users and readers. The first biological catalogue was compiled in the

ancient Greece; consisting of the grouping of animals with comparable characteristics into types, and then distinguishing the species within the types (Pellini and Jones, 2011).

Historically, classifications, arrangements and taxonomies were all considered synonymous. Interestingly, the field of biology played a key role in the development of taxonomy as a distinct effort. This resulted from the collaboration of two biologists who had opposing views on how to organize and arrange the fast expanding species knowledge base. Furthermore, cataloguing system development proceeded to expand into new knowledge categories. The Dewey Decimal System, which was created in 1876 as the main catalogue system for libraries and is still in use today, is one of the most prominent classification systems. Bloom's Taxonomy, which was first presented in 1956 by B.S. Bloom and is considered fundamental within the education community, is another renowned taxonomy. It classifies the different learning objectives educators can set for learners: affective, psychomotor and cognitive. During the 1980s, the enormous expansion of computing helped drive the shift from information transfer to digital information transfer, thus enabling the distribution of information on a much larger scale. The introduction of the internet in the 1990s aided in the tremendous expansion of information transmission, necessitating the development of new tools and abilities to organize and retrieve digitized data (Pellini and Jones, 2011).

5.2.2 Definition of taxonomy

The word "taxonomy" is derived from the Greek words "taxos," which means "order," and "nomos," which means "rule." The phrase first appeared in the realm of biology, where it was used to classify biological material. To be familiar with taxonomies nowadays, though, you don't have to be a biologist. Taxonomy is utilized in a variety of fields, including psychology and information technology. It's very beneficial for content management and information architecture in information technology. Taxonomy is also commonly used in websites to categorize web pages or resources like audio, video, and material (Sujatha and Rao, 2011). Interestingly, taxonomies are very common, and most people use them without realising they are doing so. They are present in everyday surroundings; including in the modern supermarket, where goods and products are classified according to use and importance. The most common taxonomy application many people use every day are the folder structures in computer systems, and email inbox folders.

According to Bailey as reported in (Nickerson *et al.*, 2009), taxonomies have several advantages, including the reduction of complexity and the detection of similarities and contrasts across items. Furthermore, taxonomies allow researchers to investigate item relationships and, as a result, make hypotheses regarding those links.

A taxonomy is also defined as a classification scheme which can categorise related things together (Patrick, 2007). Many classification schemes are indeed based on similarity of attributes. Hanley (2005,p.1) on the other hand, defined taxonomy as a hierarchical or networked structure of relevant topics and subtopics. A library card catalogue is a classic example of a taxonomy; the same holds for the hierarchical structure of topic on Yahoo portal (Hanley, 2005)

5.2.3 Educational taxonomy

The concept of taxonomy was adopted by Benjamin Bloom from scientific to instructional uses. Taxonomy, he said, should reveal the links between groups of events, not only label observations. The construction of a taxonomy must also be based on some reasonable ordering scheme between the phenomena being represented in the taxonomy (Salmons, 2019). Educational taxonomies provide an organizational framework for educators to use to structure progressively more complex learning activities by showing relationships between concepts and the skills required to understand and use them. Taxonomies can help educators communicate more effectively by offering a common vocabulary for discussing solutions to varied educational problems. (Salmons, 2019).

Three key skills are required to effectively design taxonomies, these are: Content organisational skills - a combination of data modelling and library science; understanding of the subject to be modelled; and knowledge of the end user who will govern the taxonomy (Hanley (2005).

5.2.4 Types of taxonomies

Patrick (2007), identified lists, tree structures, hierarchies, poly-hierarchies, matrices, facets and system maps as different types of taxonomies.

- **Lists:** They are the most basic kind of taxonomies required for non-complex issues. A list may also be thought of as a first step toward more complicated taxonomies, in which sub-categories are applied to the list's key elements. A list should have between 12 and 15 elements in it. When it becomes longer or more involved, it is recommended to use a different taxonomy form, such as a tree structure. it is advisable to adopt a different taxonomy form, such as a tree structure. In the context of this research, examples of eLearning frameworks or models such

as Khan, blended multimedia, and orbital eLearning frameworks can be considered as lists of the main element eLearning framework. These lists are more than 20 in number, and as a result, it is not advisable to use this type of taxonomy for the classification of eLearning frameworks or models.

- **Tree structures:** The tree's branches let us identify between broad and narrow groups, as well as show cause and effect linkages in a taxonomy. Hierarchical and horizontal relationships are also shown in this kind of taxonomy. It is the most used taxonomy in enterprises. It's typically employed when concepts need to be subdivided into subcategories based on well-understood and agreed-upon criteria, or when lists get too large. In the context of this research, proliferations of eLearning frameworks and models, are expected to be divided into subcategories based on the common characteristics that these subcategories have, so as to guide institutions on the selection of an appropriate eLearning framework. For example, eLearning frameworks can be divided into subcategories based on characteristics such as: Technology, pedagogy, and culture.
- **Hierarchies:** Are a particular type of tree structure. They can be modeled as pyramidal structures, with predictable and consistent transitions from one level to the next. In biology, hierarchies are useful, but they can cause confusion by giving the sense that all taxonomies should be hierarchical and that they will only be valid if they are. On the other hand, Ngassam (2007), pointed out that apart from the hierarchical nature of taxonomies, it may also refer to relationship schemes, such as network structures, class hierarchies, and classification of software components. A taxonomy might also be a simple organisation of objects into families, groups, or even an alphabetical list. This generally creates tensions and debates within an organization regarding which terms, sectors, or departments should be represented at the top. Hierarchies are often frequently too inflexible to accommodate an organization's complexity. In this research, some hierarchical relationships may be shown in the taxonomy of eLearning frameworks or models. For instance, eLearning frameworks or models, can be considered as the parent of the hierarchy, and each of the building blocks that make the eLearning framework, are children in the hierarchy.
- **Poly-hierarchies**: In a real-life context, items can also belong to many classes. As a result, poly-hierarchies can accept issues that fall into multiple categories yet don't fit neatly into tree topologies or hierarchies. They are intricate graphic representations that frequently include

several linkages between categories and words. When hyperlinks enable for hopping between categories and cross-references, they operate well. Matrix and aspects taxonomies are superior when cross-references get too numerous. In the context of this research, there is no possibility of an item belonging to different classes or categories.

- **Matrices:** Working with a well-defined body of knowledge that can be organized in two or three dimensions is the best way to go. Once the categories are written out, they can make sense of them and show any gaps or missing categories. Matrixes do not work effectively when there are more than three dimensions. Mendeleev's periodic table of the elements is one of the most well-known two-dimensional matrices. The European Commission (EC) organization matrix is an example of how two-dimensional matrices can be used in business. There is no well-defined body of knowledge in the area of this study. As a result, no matrix taxonomy is required to classify eLearning frameworks or models.
- **Facets:** A faceted taxonomy is a taxonomy that is made up of numerous smaller hierarchies, or facets, that can be searched together. People, organizations, themes, products, locations, and activities are examples of common facets (Hedden, 2008). Facets are the greatest type of taxonomy to use when there is a lot of material, and they are the best type of taxonomy to use when there is a lot of metadata and tags on digital documents (Patrick, 2007). They come in handy when tree structures have grown to be too enormous and intricate. Facets aren't maps, and therefore don't have the same level of clarity. They also necessitate a certain level of maturity among users; newcomers to an organization may struggle to understand the categories, and searches may yield empty results. Facet classification is used by e-commerce companies and companies with extensive publication libraries to allow users to access specific content from a variety of angles. For example, the search tool on www.amazon.com allows users to look for a book by searching through books, audio books, authors, themes, editors, and so on. In the context of this research, the facets type of taxonomy is not appropriate because it is really only applicable for large and complex tree structures, which is not true in this research.
- **System maps:** System maps are visual representations of a knowledge domain that indicate closeness and connections between categories, as well as real-world linkages. They're useful when there's a logical system of knowledge that can be visually communicated. They're similar to mind maps in that they provide a very visual representation of relationships between

significant concepts. System maps are frequently used to describe business process taxonomies. Faceted taxonomies are more effective when they grow too complex. This type of taxonomy is also needed for more complex representation, which is beyond the scope of the taxonomy in this research.

5.2.5 Basic attributes of a taxonomy

The produced taxonomy should be evaluated against the following attributes in order to satisfy the user of the taxonomy (Nickerson *et al.*, 2009).

- **Concise**: For a classification, or taxonomy to be concise and easy to understand, it should only have a few dimensions, and each dimension should only have a few attributes. In the context of this research, the number of dimensions and characteristics of eLearning frameworks that are included for purpose of classification are not more than seven, and therefore are not complex or difficult to understand.
- **Inclusive**: For a classification to be inclusive, a classification must have enough dimensions and features to be completely represented in the taxonomy tree. A taxonomy with only one dimension and two traits inside that dimension, for example, would be unworkable. In the context of this research, there are more than two classes that are represented in the taxonomy tree.
- **Comprehensive:** It should include a classification system for all present items in the domain in question. In the case of this research, all existing eLearning frameworks can be classified under the classification scheme shown in the taxonomy tree.
- **Extensive**: Here, when new types of items develop, a categorization should be able to accommodate more dimensions and new features within a dimension. In the case of this research, the taxonomy developed is able to incorporate additional dimensions and new characteristics without loss of generality.

5.2.6 Basic Methods of constructing taxonomies

Taxonomies can be generated manually and automatically as detailed in the following subsections.

- **Manual approach to constructing taxonomies**

  This approach of taxonomy construction enlists the assistance of domain specialists with extensive experience in a given field. It gives you a lot of control over synonyms and concept order. The choice of terminology, while constructing the taxonomy, is left to

domain experts. This method has the advantages of human decision-making, high precision and disambiguation. It is however, labour exhaustive, is not scalable, and is costly in terms of resources (Sujatha and Rao, 2011).

According to Hanley, taxonomies that are developed manually are costly and require much effort, but some manual effort is almost always required. Manual construction was traditionally the most common method of constructing taxonomies. A good taxonomy designer begins with existing structures, and uses these structures to propose new taxonomies that are reviewed with domain experts (Hanley, 2005).

As this is the first attempt at classifying eLearning frameworks, the manual approach is the most practical for the purpose of this study.

- **Automatic approach to construct taxonomies**

Several automatic classification tools are available for classifying content or to generate taxonomy structure. For example, automatic taxonomies can be generated from large text corpus using techniques such as WordNet (Lexical Database Dictionary) and NLP (Natural Language Processing). Different techniques are sometimes used in combination to enhance taxonomy construction. Various algorithms, including: Statistical analysis, Bayesian probability, and Clustering, are applied to tools that create taxonomy structure. Clustering algorithms, for example, apply a combination of annotations and keywords as tags to generate automatic taxonomies. However, automatic construction techniques provide the least amount of control over synonyms and order of concepts. They also require refinement of the concepts to make it easier for the user to understand. While these automated techniques can save time, human judgment should be used to verify if the required concept is present in the taxonomy. Automatic taxonomy generation methods can handle large volumes of data, and can be measured easily and cheaply, but suffer from problems of weak algorithms, inaccuracy, and difficulty in training users (Sujatha & Rao 2011). These automated classification tools build a taxonomy by analysing content from a collection of documents. Some of the automatic classification engines incorporate machine learning algorithms, which help the engines train themselves by using example data (Hanley,2005).

5.2.7 An approach to taxonomy development in the field of information systems

An artefact is a taxonomy development approach that adheres to the design science paradigm. Phenetics and cladistics are two ways of developing a taxonomy in the field of biology. Phenetics, also known as numerical taxonomy, is a technique that clusters organisms with similar characteristics into one. Cladistics, on the other hand, divides species into groups based on their evolutionary links rather than their common characteristics or degree of similarity. Thus, in cladistics, organisms that have a common ancestor, but do not share common characteristics, may be clustered in to one group. However, these organisms cannot be grouped in to one cluster as in the case of phenetic analysis (Nickerson *et al.*, 2009).

The approach to developing a taxonomy in the field of information systems is more like phenetics; looking at the characteristics of the objects being examined, identifying appropriate dimensions and then categorising similar objects onto groups. However, before starting to develop the taxonomy, it's critical to choose the most complete, or meta-characteristic, to use as the classification's foundation. The meta-characteristic should be chosen based on the taxonomy's goal. For example, if the purpose of the taxonomy is to classify eLearning frameworks based on to what extent the framework incorporates the seven building blocks of the generic framework, and to what extent they are matured, then the meta-characteristic would be a representation of the building block, as well as a metric representing its maturity.

In this research, the approach to develop the taxonomy follows Bailey's three-level indictor model with particular emphasis on the first level of the model, which is empirical to deductive. For the construction of taxonomies in the field of information systems, it is the most appealing and practical. (Nickerson *et al.*, 2009). This model employs both deduction and empiricism; empirical to deductive and deductive to empirical reasoning.

A Taxonomy T is defined as a set of n dimensions D_i $(i = 1, \dots, n)$ each containing of k_i $(k_i \geq 2)$ equally exclusive and collectively exhaustive characteristics C_{ij} $(j = 1, \dots, k_i)$. The purpose is to create a taxonomy with a set of dimensions, each of which contains a set of attributes that adequately defines the objects in a given domain in the field of information systems (Nickerson *et al.*, 2009).

The following eight steps in Bailey's three-level indictor model:

1. Explore a subset of entities that are going to be categorize. These entities should be the most familiar and easily accessible.
2. Identification of general distinguishing characteristics of objects.
3. Cluster characteristics into dimensions to generate the primary taxonomy.
4. Conceptualised new characteristic and dimensions.
5. Examine new objects for new characteristics and dimensions.
6. Review the taxonomy to produce next version.
7. Detect missing objects in the taxonomy.
8. Design new objects.

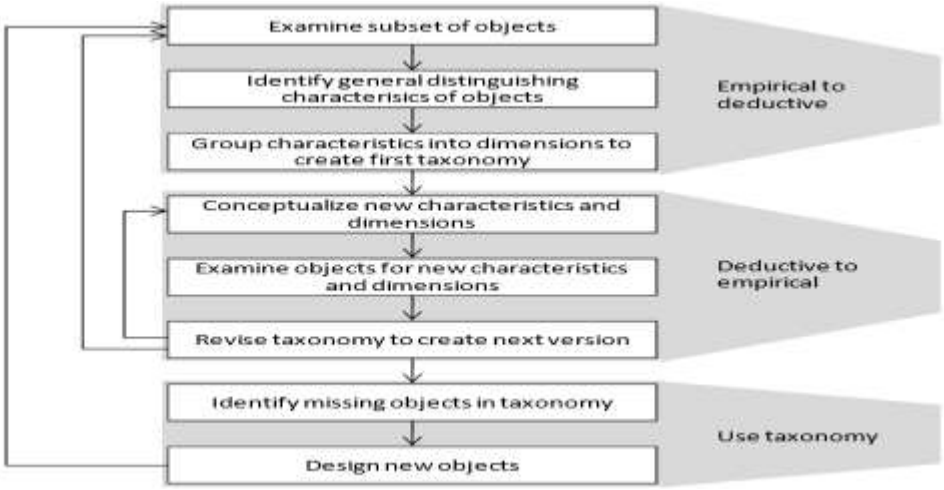

Figure 5-1: Taxonomy development method adapted from (Nickerson et al 2009)

The first three steps are called level one (empirical to deductive). These steps begin with empirical data to create the taxonomy. The next three are called level two (deductive to empirical), here conceptualisation of new characteristics of objects is considered, and based on that the analysis the taxonomy will be revised. The last two steps are called level three (or use taxonomy).

This research followed Bailey's model by identifying the majority of the eLearning frameworks found in the literature, and their characteristics were explored to identify a general distinguishing characteristic. Thereafter, the characteristics were grouped into seven building blocks, namely: institutional, pedagogy, culture, technology, management, evaluation, and ethics. These building blocks represent the distinguishing characteristics of the existing eLearning frameworks. Ultimately, eLearning frameworks can be grouped into clusters based on the extent to which they

incorporate the seven building blocks, as well as their associated maturity. For example, some frameworks may be more pedagogy-centred, while some may be more technology-centred, and others may combine pedagogy and technology, and so forth.

5.3 A Proposed Taxonomy for eLearning Frameworks

Taxonomy is beyond just classifying observations; it is also about clarifying the relationships among classes of phenomena (Bloom, 1956 cited in Pellini and Jones, 2011). Similarly, taxonomy may also refer to relationship schemes. It might also be a simple organisation of objects into families, groups, or even an alphabetical list (Ngassam, 2007, p.82-84).

The ultimate purpose of the taxonomy in this research is to enable learning institutions to make informed decisions based on their core characteristics about the most suitable eLearning solution to be adopted in their institution. The construction process and development of the proposed taxonomy trees will be discussed in the sections that follow.

5.3.1 Taxonomy construction process

In this study, the manual method was used for the creation of the taxonomy tree, because it tends to be more accurate than the automatic approach. However, the main motivation behind using the manual approach is that this researcher has not considered automation as appropriate in the scope of this research. The taxonomy tree structure shows hierarchical and horizontal relationships of building blocks of the generic eLearning framework. The construction process partially relied on Bailey's empirical to deductive approach (Nickerson *et al.*, 2009).

The proposed taxonomy tree was developed through the following four steps:

- Step1: Consider the generic formalism of an eLearning framework be $f(B, W, \alpha)$ where f denotes the framework; B represents all building blocks defined in the generic framework (see chapter 4); W represents the set of all weights associated to each building block; and α represents the scoring factor of each building block that determines the level of maturity of the framework. Considering that the formalism as presented is abstract at the start, it follows that when building the tree at root level, there are at least 7 alternatives on the maturity of the framework. These alternatives can be seen as classes in the variation.
    - Alternative 1- A framework can be very matured pedagogically, meaning that α tends more toward pedagogy than any other building block and as such the weight of pedagogy in the framework is the highest

- Alternative 2 – very matured Technologically, i.e., the highest weight is assigned for technology
- Alternative 3- α tends more toward Management (management is the most performing building block in the institution at the time of evaluation).
- Alternative 4- α tends more toward Ethics (Ethics is the most performing building block in the institution at the time of evaluation).
- Alternative 5- α tends more toward Institutional (institution is the most performing building block in the institution at the time of evaluation.)
- Alternative 6- α tends more toward Evaluation (evaluation is the most performing building block in the institution at the time of evaluation.)
- Alternative 7- α tends more toward culture (culture is the most performing building block in the institution at the time of evaluation)

- **Step 2**: Consider f as the root node of the taxonomy tree.
- **Step 3:** Use α as the element to provide the branches in the taxonomy tree by looking at its variations.

Step 4: From the root, which is an abstract node, seven different derivations guided by the tendency of α are generated:

- From each internal node, another six different derivations depending on the tendency of α are generated.
- This process will be repeated until no more alternatives remain as shown in the figure below, and observe that the path in red started from 6 alternatives until there are no more alternatives.
- Only leaf nodes represent matured eLearning frameworks, a framework at the leaf has all its building blocks matured.
- Any internal node in the tree is immature, meaning that, it requires more effort to lead to maturity by improving the maturity of some building blocks.

The notion of taxonomy development in this research relies on the relationship between or among building blocks, their weight, as well as their maturity to represent the efficiency of a framework. An optimal framework is one in which all the building blocks have the required scoring factor and therefore the scoring factor of the framework will also be very good. Each node in the taxonomy tree represents a framework in real-life context except the root node, which is abstract, and only

represents a formalism for the framework. Nodes other than the root node are called concrete, and they represent real-life frameworks. At any given time of its life-cycle, an institution eLearning framework can be found in the taxonomy tree upon conducting a maturity assessment.

Similar to other taxonomies, the taxonomy development in this study starts by identifying the main features of the existing eLearning framework. As has been identified by this research, the main features of the generic eLearning framework, are the seven building blocks, their weights and score factors.

It is the score factor (alpha) that determines all variants of the node in the taxonomy tree. The weights and score factor of those building blocks are considered to be in the process of developing the taxonomy because they have an undeniable role in determining the maturity of any framework embedded in the tree.

5.3.2 The Taxonomy Tree

The taxonomy tree, as illustrated in Figure 5.2, begins with an abstract node or root node. The root node is called abstract since it doesn't represent any real-life eLearning framework, rather it represents the formalism of an eLearning framework $F(B, W, \alpha)$.The abstract node only shows that the generic framework is a function (the aggregation result) of, building blocks, their respective weights and score factors. The score factor shown in the tree is the one that determines the maturity level of the framework. Following the root node, seven branch nodes are generated. These nodes are called concrete, and represent some real-life eLearning frameworks. Each node is more prone to one of the building blocks of the generic eLearning framework than each other. One of the branches may represent a framework that is more prone to pedagogy, meaning that pedagogy is the most performing building block of the framework. Another other may be more prone to technology, and so on. Every node of these branches is expected to generate six other branches as a third level node. Each node in the third level is also expected to generate five other branches as a fourth level of the tree. The tree traversal will go on in this fashion until it reaches the leaf node, or when there is no building block left among the seven building blocks. A node, other than root and leaf node, is called an internal node, and considered to be immature, since it needs some effort to move to the status of maturity by improving the maturity level of some building blocks. The red line depicted in the taxonomy tree (Figure 5.2) represents an optimal framework that has all the building blocks matured, or has the right score factor. The green node in the taxonomy tree represents a framework that has the most performing technology and pedagogy building blocks,

but doesn't encompass any other building blocks with the required maturity. Hence it requires much more work to make this framework matured. On the other hand, the yellow node represents a real-life framework that is only more prone to institutional building block. The green and yellow nodes are not leaf nodes, rather they will be followed by some more branches and nodes that are expected to be part of the whole taxonomy tree, but are not visible in the proposed taxonomy, for the sake of having a concise, clear and readable taxonomy.

The total number of nodes can be generated through the formula: 7+7*6+7*6*5+7*6*5*4+7*6*5*4*3+7*6*5*4*3*2+7*6*5*3*4*2*1 and the result is about 13699 different frameworks which represents a very rich knowledge base for other researches in eLearning. If more building blocks are added to the generic eLearning framework, the possible number of frameworks will be even larger. The total number can be calculated using the generic equation [8]

Let:

- *N* refer to the number of frameworks in the taxonomy tree
- *n* refer to the number of building blocks in an eLearning framework.
- *m* represents number 1

The total number of frameworks in the taxonomy tree can be calculated using the equation [8] mentioned below:

$$\text{No of frameworks in the taxonomy tree} = N_n = \sum_{m=1}^{n} \frac{n!}{(n-m)!} \quad [8]$$

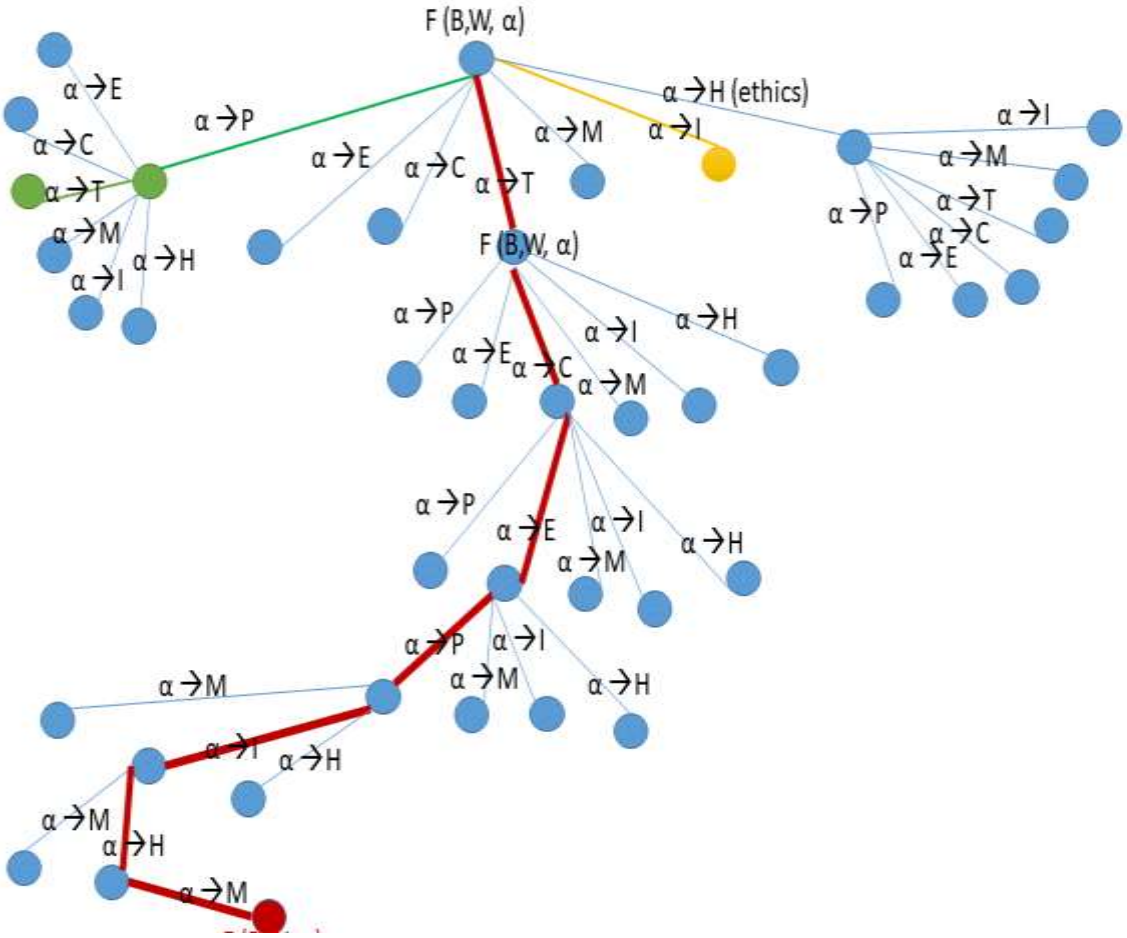

Figure: 5-2. Taxonomy of eLearning frameworks

5.3.3 Application of the taxonomy tree

The taxonomy tree enables one to see differences in existing and new eLearning frameworks. From the tree, a number of eLearning frameworks can be derived as necessary. For instance, a framework that is more prone to technology such as the synchronous framework, or adjunct framework, can be found by traversing from the root node to the node $\rightarrow T$, in the first level of the tree. Similarly, frameworks that are more prone to technology and pedagogy, such as the mixed framework, and the online framework, can be found by traversing from the root node to the node $\alpha \rightarrow T$ & P, in the second level of the tree. These examples are illustrated in Figure 5.3.

The red line in the taxonomy tree can represent some real-life frameworks such as Khan, blended multimedia, etc., although these frameworks are not as matured as the hypothetical framework represented by the red line in the tree.

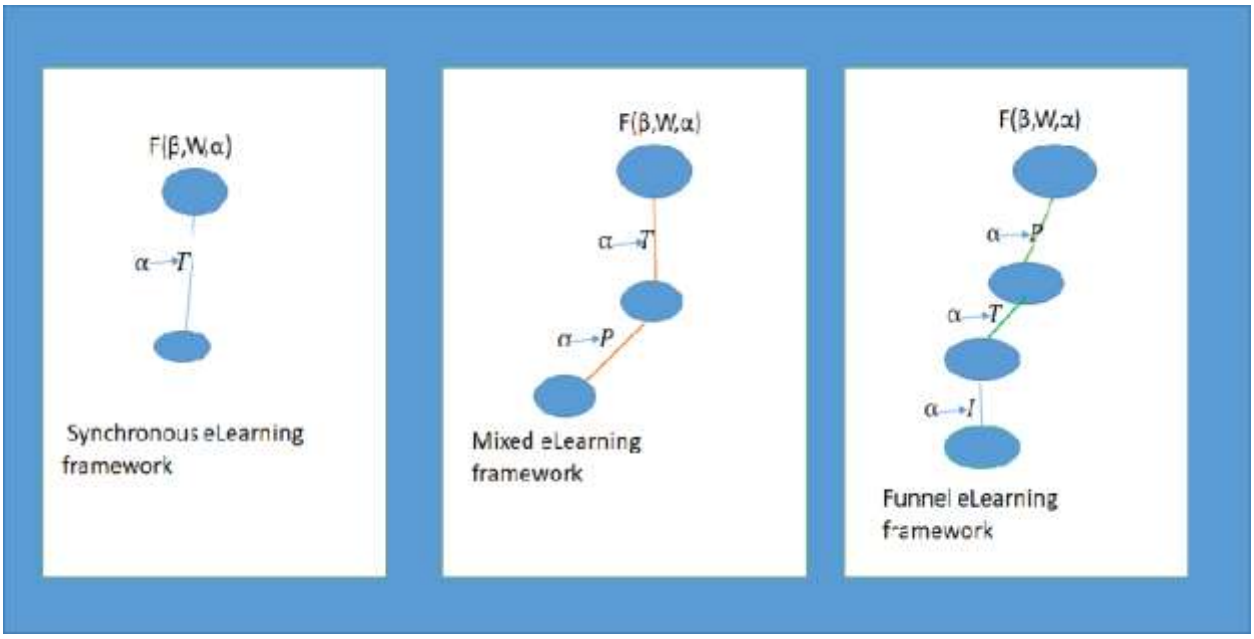

Figure 5-3.Representation of some frameworks in the taxonomy tree

Above all, the taxonomy tree can be used to represent various real-life eLearning frameworks, along with component details. Any real-life framework that is more prone to pedagogy will be found in the first level of the tree and if the real-life framework is more prone to pedagogy and technology, it can be found in the second level of the tree. These frameworks only have one or two building blocks and lack the rest of the building blocks of the generic eLearning framework. It can concluded, therefore, that more work is required to make these frameworks mature and to incorporate the rest of the building blocks with the required maturity. Only then will the optimal maturity of the framework be achieved. The above procedure will be repeated so as to derive some other real-life eLearning frameworks from the taxonomy tree and evaluate their level of maturity. The taxonomy tree can also be used to perform a maturity assessment of the learning institution and determine at which stage it is in the taxonomy tree. For example, if the outcome of the assessment shows that the most performing building block in the framework is (P) that path can be used to identify the next most performing building bock. This may be building block (T). If the performance of other building blocks are negligible, the conclusion can be drawn that the eLearning framework is strong in pedagogy and technology but lacks the rest. This framework is

illustrated by the node in green in Figure 5.2. This being the case, the institution has to do more work to reach the leaf node by implementing new building blocks and improving their maturity. In the same vein, if an institution was only strong in the Institutional (I) building block and didn't incorporate other building blocks, the resulting framework would be the one represented in yellow in the taxonomy tree. In this situation, therefore, considerable effort should be made to integrate the rest of the building blocks with the required maturity. Furthermore, the taxonomy tree can be implemented and relied upon to label any new framework that comes up in the literature. Apart from the existing eLearning frameworks, new eLearning frameworks can be derived and represented in the taxonomy tree. The tree could also initiate some comparative studies that could give emphasis to identifying the building blocks that deserve prior attention. These building blocks should be given priority to move them, and the framework as a whole, to the required stage of maturity. Above all, the taxonomy tree could give a clear and consolidated view of existing eLearning frameworks, and thus enable the development of new building blocks, which would further enrich the knowledge base. Additional building blocks could be included in the taxonomy tree: those to be yet discovered by researchers or even building blocks that have been overlooked by present research. These can be added as an additional branch to the taxonomy without impacting the whole. In addition, a new branch can also be added at an internal node without loss of generality allowing even more frameworks to be studied.

5.4 Chapter Conclusion

In this chapter, the research objective **Develop a taxonomy of eLearning frameworks** was achieved through answering the research question: **"How is a taxonomy of eLearning framework developed?"**

Several steps were undertaken so as to achieve this research objective. These steps began with a literature review on basics of taxonomy and taxonomy construction. Under this sub-section, history of taxonomy, definitions of taxonomy, types of taxonomy, attributes of taxonomy and the like were discussed. Educational taxonomy was another other issue discussed in this chapter. Educational taxonomy is a kind of taxonomy that can structure more complex learning activities by providing an organisational framework. Following this, the fact that taxonomy development can be done either manually or automatically was discussed.

Bailey's three-level indictor model of taxonomy development in the information systems field was discussed, and partially applied in this research. This model was chosen as an approach to taxonomy development since it is the most practical for the development of taxonomies in the information systems field. Furthermore, a taxonomy tree was proposed and its application in reality was demonstrated. The taxonomy tree developed in this chapter demonstrated the formal relationship between and among eLearning frameworks and models.

In the next chapter, data collection to validate the generic eLearning framework and a methodology for eLearning adoption will be explained. In addition, data was also collected so as to demonstrate selection and adoption of eLearning framework in higher learning institutions using the taxonomy tree.

6 CHAPTER SIX: DATA COLLECTION

6.1 Introduction

The generic eLearning framework as well as the methodology for eLearning adoption conceptually discussed in chapter 4 required further scrutiny in a real-life context, notwithstanding the fact that this researcher has already provided an illustration of its usability and usefulness through the pilot study at Wollo University. Therefore, those two deliverables required further evaluation and validation in a real-life context. The foregoing pertains to some aspects of the fifth sub-research question of the thesis which is: **"How are our proposed generic framework, methodology and taxonomy evaluated and validated in a real-life context of Ethiopian learning institutions?"**

In this chapter, the process of evaluating and validating Chapter 4 deliverables through data collection will be initiated. Collected data will also serve for the evaluation and justification of the deliverable in Chapter 5, which is the proposed taxonomy tree for eLearning frameworks. Issues such as the data collection method, validation of data collection instruments, testing the validity and reliability of the developed framework are discussed in this chapter. A general overview is also provided in this chapter of how data was collected from selected participants in some targeted higher learning institutions.

The remaining part of this chapter is organised as follows: In section 6.2, the overall research approach with regard to data gathering as well as the various instruments used to perform such gathering is discussed. Target organisations selected for the validation and assessment of the conceptual deliverables are discussed in section 6.3 followed by the profile of participating eLearning experts in section 6.4. The population for the study and specific samples of the study are discussed in section 6.5 followed by section 6.6 which discusses validity and reliability issues of the measurement model. In Section 6.7, limitations in the process of data collection in particular and the whole research process in general are discussed. The conclusion of the chapter is provided in section 6.8.

6.2 Research Approach

The data collection strategy used in the study may be dictated by the research approach chosen. The quantitative and qualitative approaches to research are the two most common types. The former entails the collection of quantitative data that may then be submitted to rigorous quantitative analysis in a formal and rigid manner. On the other hand, the qualitative method to research is concerned with subjective evaluation of attitudes, views, and behavior. As a result,

qualitative research is a function of the researcher's perceptions and insights. Such a study approach yields outcomes that are either non-quantitative or have not been submitted to rigorous quantitative examination. The tools of focus group interviews, projective approaches, and depth interviews are used in this approach (Kothari, 2004).

With slight difference from the above, Pavelek (2013) argues that in terms of what data is obtained, there are three common approaches to research. These approaches are qualitative, quantitative and mixed-method approaches. The qualitative approach is one that aims to describe a phenomenon in its natural setting, with qualitative data based on inductive reasoning as a result. The quantitative approach, on the other hand, is a way for evaluating objective hypotheses by examining the relationship between variables. To estimate these components, statistical approaches are used. The mixed approach lies between these quantitative and qualitative approaches. Because both quantitative analysis and attitude evaluation were used in this study, it was conducted using a mixed-methods technique.

6.2.1 Data gathering

After a study problem has been determined and a research design and plan have been outlined, the work of data collection begins. Data gathering techniques are divided into three categories: qualitative, quantitative, and mixed-method, which integrates the first two. (Creswell & Celano cited in Hastu, 2018). The mixed method of data collecting is located in the middle of the study variable continuum. Hence, in this research, mixed-method is applied since it is the most suitable and it combines components of both qualitative and quantitative approaches.

Under each of these data collection technique, there are a plethora of other data collection forms that again can be classified as quantitative or qualitative depending on the type of data it collects. Interviewing, for example, is a type of data collection that focuses on gathering non-numeric or qualitative information, whereas a closed-ended questionnaire-based survey aims to extract numeric or quantitative information, frequently in the form of Likert scores or Yes/No responses. Mixed-method research, on the other hand, combines qualitative and quantitative methodologies. (Pavelek, 2013). The data gathering tools used for this particular research are discussed in the section below:

- **Questionnaire**

A questionnaire is a data collection tool that enables researchers to collect or record information about a particular issue. It can reach a large number of respondents who are spread across a wide geographic area at lower cost compared to other data collection methods. However, response rates may be low because of the refusal or reluctance of respondents to submit or reply to the questionnaire. Structured questionnaires are mainly used to elicit quantitative data, but they may also have fixed-alternative questions designed to limit informants' responses based on stated alternatives. The questionnaire is relatively simple to administer and analyse.

In this research, a structured questionnaire was applied to gather data for validation of the framework as well as for assessment of current eLearning practice. It was also used to gather numerical data for further quantitative analysis. The majority of questions in this structured questionnaire were close-ended question, while open-ended questions with limited answers were also included.

- **Interview with experts**

An interview is a data collection and information gathering tool that requires verbal communication between the interviewer and respondents. Interviews can be conducted either in person or over the phone. Personal interviews are usually conducted in an organized manner to gather information. The usage of a series of pre-set questions and highly standardised ways for recording information are used in these interviews (Kothari, 2004). Telephone interviews are a quick way of getting information. Although not popular, a telephone interview is cheaper, and easier than a personal interview. In this research, questionnaire-structured interviews, as well as telephone interviews were used so as to collect information from eLearning experts because they were spread over a wide geographical, which made face-to-face interviews difficult. Experts' opinion about the relevance of the generic eLearning framework, methodology of eLearning adoption and current eLearning practice were gathered through telephone interviews.

- **Document review and analysis**

Data can also be collected using a qualitative technique known as document analysis. This involves examining the contents of documents related to the subject matter so as to attain the stated research objectives (Elmusharaf, Farrokhi and Mahmoudi-Hamidabad, cited in Hatsu, 2018). Document review was utilized in this study to supplement other data gathering strategies in order to answer the research questions and meet the stated research objectives. It was done through studying written documents, reports, guidelines, books, journals, and websites. In this research, this method was used for triangulation purposes, and the outcomes of the study acquired from interviews and questionnaires were again supported by review and analysis of the relevant documents.

- **Observation**

Observation is a strategy that allows a researcher to collect data in real-time from naturally occurring social settings. Instead of relying on second-hand accounts, the researcher can look first-hand at what is going on (Cohen and Morrison, 2007). It is a tool that is particularly applicable to the case study assessment of current eLearning practice. This instrument can also be used for triangulation purposes. Observation was guided by a checklist attached in appendix F and it enabled this researcher to observe computer laboratories, smart classes and eLearning administrators.

The sections that follow will discuss how the data collection methods were applied in the different phases of this study.

- **Data collection method for framework validation purpose**

Kothari (2004) proposed observation, personal interviews, telephone interviews and questionnaires as primary data collection tools for a research survey. Questionnaires and interviews were identified as the main data collection tools for the survey in this study. It has also been recommended that different data collection tools should be used for triangulation purpose. The utilization of two or more different sources of data gathering methods to supplement research findings within a study is known as triangulation (Saunders, 2012).In this study, questionnaires were administered to 100 respondents. The questionnaire has two sections; Section one consists of several items to gather data regarding personal details of the respondents such as: Gender, age, level of education and department. Section two of the

questionnaire was designed to assess the attitude of educators and learners, towards the relevance of eLearning building blocks, as well as towards the weight of building blocks of the generic eLearning framework in different educational institutions. In this study, questionnaire-structured interviews and telephone interviews, were conducted with nine experts and 18 ICT (information communication technology) instructors and researchers' using open ended questions (see appendix A).

According to Yin (2009) and Eisenhardt (2007), there is no agreed-upon amount of instances or responses to define when an interview is saturated. They proposed that, because the amount of saturation attained varies based on the type of research, the research topic, and the research objectives, the researcher should determine the point of saturation whenever no new evidence arises by interviewing further informants (Yin, 2003 cited in Hagos, 2019). Furthermore, the researcher should also use at least two data sources to cross check the data collected, and to determine the point of saturation (Pan &Tan, 2011 cited in Hagos, 2019)

The 27 interviews produced almost similar results. Furthermore, two sources of data were used to cross-check the results of the study. Consequently, these results imply that the point of saturation was reached in this research

- **Data collection method for validating a methodology for eLearning adoption**

In order to test the practicability of a methodology for eLearning adoption, a questionnaire survey consisting of five-point was used. Likert-scale type of questions, and its objective was to investigate the attitude and belief of experts towards the proposed methodology for eLearning adoption. This survey specifically targeted experts that were involved in the preparation and implementation phases of eLearning projects within their institutions. Almost all of the 115 experts from Arba Minch, Jimma, Adama, Addis Ababa Science and Technology (AASTU), Civil Service University, Bahir Dar, Mekelle and Wollo universities participated as respondents in the survey. Questionnaire-structured interviews with nine experts were also conducted to supplement the result obtained from the questionnaire.

- **Data collection methods used for selection of a framework from the taxonomy tree**

A survey-based case study was also used in this section of the research on a framework for the taxonomy tree. The generic framework developed in Chapter 4 informed the main features of quality eLearning and this was used to guide the data collection process in this case study. In addition to the questionnaire adapted from the previous eLearning related researches, the questionnaire for this study was based on the concept of the seven building blocks (institutional, pedagogy, culture, technology, management, evaluation, and ethics) of the generic eLearning framework. The metrics required to measure each building block also guided the questionnaire development process in this case study.

Both qualitative and quantitative research methods were used in this study. Judgment sampling that is one type of deliberate sampling technique is the most regularly used sampling method in qualitative research method (Kothari 2004). In this technique, the researcher's judgment is used to select items which they consider to be representative of the population. Based on this researcher's judgment, three Ethiopian public universities: Jimma, Arba Minch and Adama, were purposely selected to participate in the study. This researcher believed that this sample size would be sufficient to demonstrate validity. Qualitative research methods require triangulation, and as a result more than one tool was used to collect qualitative data in order to be able to triangulate the findings. In this research, questionnaires, questionnaire-structured interviews, observation and document review were used as data collection methods. Data were collected from the selected Ethiopian institutions of higher learning over the period from December 2016, to September 2019.

In this survey based-case study a questionnaire-structured interview guide was uploaded on Google forms for a total of 37 technical staff (experts), ICT directors, learners and teachers. In addition, 297 questionnaires were administered online to 87 instructors and 210 learners. In addition, document analysis and observations were also made. There is no standard rule for point of data saturation for in-depth interviews. However, Saunders (2009) recommends that in order to reach data saturation, at least twelve in-depth personal interviews be conducted within the same context; meaning, one institution, or one department, or among similar groups. These recommendations were followed while conducting the interviews for this research. To this end, more than twelve interviews with ICT directors, eLearning experts, learners and instructors were conducted for each of the sample institutions.

Document analysis was another data collection tool in this research study that used additional stored data of reports on formal matters in an organisation (Cohen *et al.*, 2009). It is also used for triangulation purposes. The document analysis in this study was guided by the checklist attached in the appendix G. It enabled this researcher to refer to eLearning polices and guidelines, reports and minutes and so on.

Table 6-1: Summary of the overall purpose of data collection and the tools used

Purpose of data collection	Population	Invited Participants		No of Questionnaires filled online		No of interviews made				Document analysis	Observation
		students	Instructors	Students	Instructors	ICT directors	experts	students	instructors		
validating generic framework	JU	135	30	38	8	1	1	1	1	✔	✔
	AMU	115	35	32	8	1	1	1	1	✔	✔
	ASTU	50	20	-	2	1	1		1	✔	✔
	CU	50	10	10	2	1	-	-	-	✔	✔
validating methodology of eLearning adoption	JU		30		14	1				✔	✔
	AMU		55		25	1				✔	✔
	ASTU		30		2					✔	✔
	AASTU		45		12				1	✔	✔
	MU		35		20					✔	✔
	BDU		40		22					✔	✔
	WU		40		30		1			✔	✔
	CU		15		4		1			✔	✔
Assessing current eLearning practice and selection of an appropriate framework	JU	150	65	90	38	1	3	8	4	✔	✔
	AMU	200	70	120	40	1	3	8	4	✔	✔
	ASTU	100	35	-	7	1	3	-	-	✔	✔
		800	475	290	112	7	12	18	12	✔	✔

6.2.2 Data description

Overall, data that were collected in this research were both of qualitative and quantitative nature. The data collected from all participants; namely, instructors, learners and eLearning experts,

through questionnaires were in raw format. The data was then cleaned, sorted and transformed into quantitative data for purposes of analysis. Statistical Package for the Social Sciences (SPSS) software, with frequency distribution tables and charts, was used for data analysis and representation. The quantitative data was also subjected to descriptive analysis using arithmetic mean and standard deviation. This researcher also used AMOS statistical software to perform confirmatory factor analysis in order to understand the relationships among indicators and variables. Furthermore, the qualitative data collected from experts through interviews were subjected to thematic analysis for identification of common themes using Atlas.ti 9 qualitative data analysis and research software. The analysis of collected data for the purpose of the evaluation and validation of the research deliverables will be discussed in the next chapter.

6.3 Organisations Used for Validations and Assessment

6.3.1 Jimma University (JU)

Jimma University was founded by the joining together of the Jimma Institute of Health Science and the Jimma College of Agriculture in the 1980s. Both institutions had been national leaders in their respective fields, and with their amalgamation, a versatile and development-oriented institution Jimma University (JU) emerged. JU has a history of international collaboration and named as a top ranked institution in the nation. A computer centre was established when JU started to integrate ICT into its system and the Information Communication Technology Development Director Office (ICTDO) was formed. The JU strategic plan calls for the blending of eLearning with the classical teaching and learning process. The university has been offering online programs to enable learners to pursue their educational goals. Online learners at JU are able to connect directly to distinguished faculty, other highly motivated learners and supportive staff.

Jimma University, in cooperation with Lucy Academy, offers a blended online education that is both flexible and affordable. The program is delivered using the latest technology to provide a dynamic, interactive learning environment online, 24 hours a day, seven days a week. In JU, flexible online programs that allow individuals' to learn using their own style of learning are being offered using interactive tools (Lucy Academy, 2018). A learner can choose from Bachelor's, Master's, diploma or certificate programmes in variety of fields including natural sciences, engineering, social sciences and humanities, law and governance, business and economics,

education and behavioural sciences, public health, agriculture and pedagogical certificate programs (JU, 2019).

6.3.2 Arba Minch University (AMU)

Arba Minch University (AMU) is located in the south-west area of Ethiopia. As the university's first name, the Arba Minch Water Technology Institute (AWTI) was founded in 1986. It maintains its status as an outstanding water technology center in Eastern Africa. The university was officially inaugurated in June 2004, and Arba Minch Institute of Technology, College of Agriculture, College of Business and Economics, College of Natural Sciences, College of Medicine and Health Sciences, and College of Social Sciences and Humanities are among the university's academic institutions, which offer both undergraduate and graduate programs. The university is currently embarking on a large-scale expansion and student intake initiative. Main Campus, Abaya, Chamo, Kulfo, NechSar, and Sawla are the six campuses it now maintains.

The teaching and learning process in AMU is now being supported by the eLearning system that was established by AMU investing a significant amount of money. Under the university's ICT directorate office, a responsible eLearning office with fitting staff is in existence. The university employs Moodle as its Learning Management System and provides all of the necessary eLearning and IT infrastructure to ensure its success (Arba Minch University, 2018; and personal communication with ICT director of the university).There is also an attempt to give online training for eLearning users namely: Introduction to eLearning, How to Moodle 2.0 and Teaching with Moodle 2 (AMU, 2018).

6.3.3 Adama Science and Technology University (ASTU)

Adama Science and Technology University (ASTU) was founded in 1993 as Nazareth Technical College (NTC), which offered degree and certificate level education in technological subjects. The college was afterwards renamed as Nazareth College of Technical Teacher Education (NCTTE).The purpose of the name change was to give clarity to the function of the institution. Its graduates will work at TVET colleges and schools around the country as technical teachers. In 2003, NCTTE introduced courses in business education to address the shortage of educators in vocational institutions.

Following its inauguration as Adama Institution in May 2006, the matured university began offering academic programs in a variety of fields. In 2008, the Ministry of Education nominated

the institution as Centre of Excellence in Technology. The university then opened various programmes in applied engineering and technology. The institution also introduced PhD by Research and MA/MSC by Research programs during this time. ASTU's reach was formerly limited to its main campus in Adama town. Its scope has now been extended to Asella, which houses two of the university's seven schools: the School of Agriculture and the School of Health and Hospital. ASTU is home to a number of research institutes and businesses in addition to its seven schools. After being renamed as Adama Science and Technology University by the Council of Ministers in May 2011, the university has begun to work toward being a center of excellence in science and technology.

With the help of the Korean International Cooperation Agency (KOICA), ASTU established an e-Learning centre by investing a large amount of money to support the overall teaching-learning process. ASTU, as one of the pioneers in introducing e-Learning to Ethiopia, also took the lead in providing a road map for other Ethiopian universities, such as Hawassa University, Mekelle University, and other newly opened universities, who are in the planning stages of implementing e-Learning in their teaching and learning processes. The eLearning system with the help of Moodle eLearning management system started functioning in engineering departments in 2018 (www.astu.edu.et; Ketema and Nirmala, 2015; and personal communication with expert of the university).

6.3.4 Ethiopian Civil Service University (ECSU)

The Ethiopian Civil Service University (ECSU) was founded in 1995 to assist the Ethiopian Civil Service and implement the country's development policies and strategies. The University's specific goal is to increase the capability of the civil service at both the federal and regional levels. To that end, in January 2006, an eLearning project was initiated, and ECSC was outfitted with VSAT equipment, interactive videoconferencing services, high-speed internet multimedia capabilities, broadband internet, and VC (Virtual Connection) connections (Njagi, 2013). The project's goals were to create, execute, and support two online courses in procurement and human resource management, as well as to increase the capacity of government officials across the country. The Institute of Public Development and Management Studies and the Institute of Leadership and Good Governance, respectively, have developed and hosted the modules Public Service Delivery and Ethics-Change Management and Ethiopian Public Administration and Governance since the start of the eLearning project.

These two common modules were taught across the University's 16 Master's programs, engaging over 500 students. These modules cover topics including ethics, professionalism, corruption, policies, human rights, history of public service, Ethiopian administration, public management, law, and federalism, all of which are considered required for any civil officials pursuing a Masters' degree. The use of an eLearning system in the teaching and learning processes resulted in a 50% reduction in class time ((Www.ecsu.edu.et, 2018) and personal communication with manager of the e-learning unit).

6.3.5 Bahir Dar University (BDU)

Bahir Dar University (BDU) arose from the merger of two former higher education institutions, Bahir Dar Polytechnic and Bahir Dar Teachers' College, on May 6, 2000. The university has grown to become one of the largest in the country. Colleges of Science, Agriculture and Environmental Sciences, Medical and Health Sciences, Business and Economics, Education and Behavioural Sciences, Bahir Dar Institute of Technology, Ethiopian Institute of Textile and Fashion Technology, Institute of Land Administration, and Institute of Disaster Risk Management are among the university's academic units. Blue Nile Water Institute, Biotechnology Research Institute, Pedagogy and Education Research Institute, Energy Research Institute, Textile, Garment and Fashion Design, Abay Culture and Development Research Centre, Geospatial Data and Technology Centre, Institute of Economics Research and Demographic Surveillance are some of the university's research centers.

To facilitate the teaching learning process of the university, eLearning is being implemented by investing money in eLearning experts and personnel to run the eLearning system. The university also clearly defines the eLearning staff's tasks and obligations, which include:

- Customise;
- Organise;
- Retain and manage the Moodle LMS software in all teaching and learning processes;
- Set up and configure the digital library materials, as well as providing end-user training and support;
- Arrange the LMS servers;
- Upload the curriculum; and

- Offer training for instructors and students participating in eLearning programs. (University, 2018) and personal communication with the ICT director).

6.3.6 Mekelle University (MU)

Mekelle University (MU) was established in May 2000 as an autonomous higher education institution by merging Mekelle Business College and Mekelle University College. Mekelle University is funded by the government of Ethiopia and has a high international reputation in teaching, learning, research, and collaboration with sister institutions at the national and international level (University, 2018 and personal communication with head of the eLearning unit).

Since its inception, MU has proven to be one of Ethiopia's fastest evolving universities. To facilitate the teaching-learning process and other related activities of the university, eLearning projects have been started with the help of Ethiopian capacity building programme (ECPB). The ECPB, in collaboration with Alkaline University in Spain, are involved with the implementation of eLearning at Mekelle University through the Digital Campus project. This was started as a pilot study to implement eLearning in engineering and the College of Health Science, because of the availability of computers and labs (Berhe, 2011). In addition, an eLearning office has been established to oversee the amalgamation of the university's eLearning system, IT infrastructure, and end users in order to achieve the university's goal of becoming a model for technological hubs across the country. (http://www.mu.edu.et and information from head of the e-learning unit).

6.3.7 Addis Ababa Science and Technology University (AASTU)

The Addis Ababa Science and Technology University (AASTU) was established in 2011 by the Council of Ministers Directive No. 216/2011, and the first class of 2000 students was admitted in November 2011. The foundation of the institution is directly linked to the Federal Democratic Republic of Ethiopia's government's Five-Year Growth and Transformation Plan (2010-2015). The institution is well situated to help Ethiopia become a more economically developed and industrialized country. The AASTU plays a critical role in Ethiopia's technological revolution by forging strong ties with industry and resolving challenges faced by Ethiopian industries. It also conducts research that is acknowledged by the continental and international communities. To this end, the university–industry linkage (UIL) has been strengthened (AASTU University, 2018)

To facilitate the teaching-learning process in AASTU, an eLearning portal has been designed. As a result, at AASTU, the emphasis on eLearning is on content rather than interactions between students and tutors (http://www.aastu.edu.et and personal communication with the head of department).

6.4 Profile of eLearning Experts

Experts selected for the purpose of validating the eLearning framework are all well experienced in the area of eLearning and their details are described below. Other respondents, particularly instructors selected for interviews and respondents to questionnaires, either worked as ICT directors, or were employed in the eLearning centre providing courses to learners through their eLearning portals.

- **Expert 1** is a professor in Kennesaw state university USA. He's been teaching and researching for more than 21 years in the field of information systems.
- **Expert 2** is an assistant professor in the University of Namibia. He has more than 16 years of teaching and researching experience in the field of computer science. He's done a lot of research in the field of technology-assisted learning.
- **Expert 3** is an assistant professor of the African Universities. He has more than 16 years of research experience in the field of eLearning and ergonomics.
- **Expert 4** is a Senior Lecturer at Arba Minch University's Department of Computer Science. He has over 15 years of expertise in teaching and related fields. He is also a PhD holder and was doing research on blended eLearning instruction. He makes extensive use of the eLearning portal at Arba Minch University, and is interested to do more research in the area of eLearning.
- **Expert 5** is a researcher and consultant in Addis Ababa. He researched his PhD in the field of eLearning. He has more than 15 years of experience in teaching and researching, and has authored numerous publications in the area of eLearning.
- **Expert 6** is a PhD graduate and eLearning researcher. In the topic of eLearning, he has written a number of articles.
- **Expert 7** is a researcher and PhD graduate in the field of eLearning. He is currently working in the University of Nairobi. In the topic of eLearning, he has written several articles.

- **Expert 8** is a doctoral alumni and eLearning researcher. She published a number of articles in the field of eLearning.
- **Expert 9** is a PhD graduate and researcher in the area of eLearning. He is working in Accra University, and has published various articles in the field of eLearning.

6.5 Sample Design

6.5.1 Population of the study

The target population for this study (from which samples were drawn for both selection and validation purposes) were learners and educators in the government sector of Ethiopia's higher learning institutes. The government sector was chosen for this study because this sector has better experience with eLearning compared to private colleges. This fact was confirmed by this researcher's telephone interviews with eLearning experts in different private and government institutions (personal communication with some eLearning experts).

The decision to focus on the government sector was also based on ease of accessibility for this researcher. Collecting data from different universities, during the data collection period, was difficult due to the political instability in Ethiopia.

There are currently more than 40 government universities in Ethiopia, but only a few, ten to be precise, were practising eLearning, during the time-frame of this study (2016 – 2018). These universities included: Arba Minch (AMU), Jimma (JU), Adama (ASTU), Bahir Dar (BDU), Hawassa (HU), Haramaya (HRU), Mekelle (MU), Ambo(AU), Addis Ababa (AAU) and Gondar (GU). Most of the universities mainly implemented eLearning in their health colleges. Of the ten universities, eight (AMU, JU, BDU, ECSU, ASTU, GU, AASTU and MU) were randomly selected for the purpose of this research, although ECSU only implemented eLearning for two common courses and ASTU was in the preparation and beginning phase of eLearning implementation.

Arba Minch, Jimma, Adama, and the Civil Service universities were purposefully selected to give questionnaires to learners, instructors and experts in both online and on a face-to-face basis for validation of the generic eLearning framework. These sample universities were the pioneers and best implementers of eLearning among those mentioned as having an eLearning presence. As a result, the instructors and learners at these selected universities were more experienced in eLearning practice than the others. To validate the methodology for eLearning adoption, another list of eight universities (Arba Minch; Jimma; Adama Science and Technology; Bahir Dar;

Mekelle; Addis Ababa Science and Technology; Civil Service, and Gondar Universities) were selected as a population of the study. For the purpose of selection of eLearning framework from the taxonomy tree, only three universities; namely, Arba Minch, Jimma and Adama universities were selected as the population.

6.5.2 Sampling techniques

The targeted respondents were sampled through simple random and purposive sampling techniques. Simple random technique is used only to select some chance population of similar characteristics. Purposive sampling is sometimes referred to by other names (such as, non-probability sampling, deliberate sampling, and judgment sampling). The items for the sample are deliberately chosen by the researcher in this sort of sampling; their choice of items is absolute. To put it another way, with purposive sampling, the investigators purposefully select a small mass from a big mass, which can be typical or representative of the entire (Kothari 2004). Hence, out of 10 universities that were practising eLearning, only four, eight and three were selected deliberately for each of the research studies because they were the best, and most experienced eLearning implementers, among the others identified.

After selecting the universities, some of the learners, educators, as well as experts from eLearning implementer departments were then also selected randomly since working with the whole population of learners, educators and experts would not be feasible due to cost and time.

For validation of the generic eLearning framework, 20 instructors and experts were selected deliberately, and 80 learners were selected randomly to fill out the questionnaire. Selection of participants for the questionnaire-structured interview and telephone interview was made deliberately, and a total of 27 ICT directors and eLearning experts were chosen for their experience and expertise in the area of eLearning.

For validation of a methodology for eLearning adoption, questionnaires were administered to 115 eLearning experts who were selected randomly from the eight universities, and interviews with 9 experts were also made randomly.

For the selection of a framework from the taxonomy tree, the researcher was able to successfully conduct a total of 20 questionnaire-structured interviews with technical experts, ICT directors, learners and teachers who were deliberately selected. Some 295 questionnaires were also administered online to 85 instructors and 210 learners randomly. In addition, document analysis and observations were also made.

6.6 Model Testing

6.6.1 Validation instrument

- **Pilot testing**

  To limit some of the weaknesses of building theory from case study research, the draft questionnaire was pilot tested before the actual data collection process. This was also one way of model testing. The questionnaires were administered to 15 instructors and 10 learners from the sample universities. Two of this researcher's PhD colleagues also participated. As a result of the pilot test, some of the questions that failed to elicit the required response because of a lack of clarity were modified. In addition, the structure of the questionnaire was modified. Regarding selection of the respondents for data collection, this researcher took the political instability of Ethiopia into consideration, and allowed instructors from the selected universities to select students who passed through eLearning courses, and data was collected based on that criterion. The ICT directors were responsible for selecting the instructors who participated in the research study. These instructors were selected based on their experience with eLearning as well as their ability to use the system.

- **Research software tools**

  The software program used to test the model in this study was SPSS V-25 with the AMOS confirmatory factor analysis module. Table 6.2 below describes the measurement model tests and threshold values while carrying out the tests. This researcher specifically selected SPSS V-25 because it is popular, and is the best to do this kind of analysis. Atlas.ti software was used to analyse the qualitative data.

6.6.2 Validity and reliability tests

Some predefined criteria should be there for research output to be evaluated and to strengthen theory building. Accordingly, Yin (2003 cited in Hagos, 2019) proposed quality criteria for case study research design. These are construct, internal and external validity, as well as reliability. Reliability deals with consistent results of research findings. Research validity is concerned with whether the result of the research is true or accurate (Bloor and Wood, 2006 cited in Hatsu, 2018). In this research, construct validity was achieved by using many sources of data collection and proof; namely, interviews, questionnaires, document analysis and observation in order to triangulate findings. Experts in the subject were also consulted, and their suggestions were incorporated into the final report. External validity can also be achieved through logic replicated

in multiple case studies. In order to replicate results, four, eight and three higher institutions were selected for each of the case studies conducted in this research. Finally, reliability was maintained by using the case study protocols attached in the appendix of this research. These data sources are readily available and can be verified.

Apart from the aforementioned qualitative research validity and reliability standards, the extensive use of empirical evidence in case study research may result in a theory that is unduly complicated, rich in detail, but lacks the simplicity of overall perspective (Weber, 2012; Yin, 2003; Eisenhardt, 1989; Miles and Huberman, 1984, cited in Hagos, 2019). The lack of quantitative measures can also miss important relationships in the data. To solve this problem of building theory from case study research, this researcher has employed quantitative measuring tools to assess the study model, improve the quality of the theory building process, and improve the quality of quantitative tests of validity and reliability.

This researcher developed the questionnaire by considering and evaluating questionnaires from previous case study research findings. The draft questionnaires were pilot tested before the actual data collection process began. Furthermore, SPSS V-25 statistical software and the AMOS module, together with Microsoft Excel were used to test the conceptual model in this study. With regard to the validation of the generic framework, confirmatory factor analysis was used to assess how well the indicator variables (components) determined the latent variables (building blocks). The measurement model tests and threshold values are described in Table 6-2.

Table 6-2: Measurement models and thresholds

Validity and Reliability Tests	Description	Values of Threshold
Unidimensionality	It states the extent the items pursue to measure only one dimension (latent variable) (Pillai 2020).	If the loading coefficient is above 0.6, an item loading is considered high (Hair et al., 2013).
Internal Consistency: Reliability	Reliability concerns the degree to which a test or a measuring process produces consistent results across time (Pillai, 2020). Cronbach's alpha and factor analysis are usually used to assess the internal consistency reliability test (Hagos, 2019; Pillai, 2020)	It is considered as satisfactory if Cronbach's alpha value is 0.70 and above, (Hair et al., 2013; Pillai 2020). Cronbach's alpha value between 0.6 and 0.8 is also acceptable (Hajjar, 2018)
Convergent Validity:	It refers to the instrument's ability to measure what it claims to measure. The degree to which two constructs that should theoretically be related are actually related is referred to as convergent validity (Hajjar, 2018).	The loadings (factor loading of items) of all measurements should be more than 0.50 to ensure convergent validity (Pillai 2020). Average Variance Extracted (AVE) > 0.5 is also widely used to measure convergent validity (Hair et al 2013; Hajjar,2018; Hagos,2019)

The structural model measurement was not applied in this research since this research does not cover the relationships among variables (constructs), as a result it is out of the scope of this research.

6.7 Limitations

The major limitation in this study is the limited number of sample organisations on which the research was conducted. The number of respondents were also very few. As was mentioned above, eLearning is still at its early stage in Ethiopia with the few universities embracing eLearning being at low maturity. This was a challenge to evaluate and validate the deliverable of this study. Furthermore, the political instability in the country made data collection challenging due to the

fact that this researcher was often unable to get learners, instructors, and eLearning experts to the appropriate place at the appropriate time for interviews or for administrating the questionnaires.

6.8 Chapter Conclusion

This chapter begins with explanations of research approaches because the selection of the research approach is critical and dictates the data collection and analysis techniques that follow. In this research, a mixed-method approach is selected since there is a need to assess attitudes of experts and also to test the frameworks developed using both qualitative and quantitative data.

A discussion then follows about the data collection techniques used, namely: questionnaires, interviews, document analysis and observation. After that, selection of the target groups consisting of experts, instructors and learners, identified for participation in questionnaires and interviews was discussed, and the use of random and purposive sampling techniques was explained. This chapter also discusses the techniques used for analysing the data collected during the research, and explains how SPSS software with the AMOS module is used to analyse quantitative data, and how the Atlas.ti software package is used to analyse qualitative data. Different reliability and validity tests of the measurement model are also discussed.

These tests include confirmatory factor analysis using the SPSS software with the AMOS module. For the Uni-dimensionality test, item loading is calculated to determine to what extent measurement items are related to their associated latent constructs. Cronbach's alpha is used to assess the measurement model's internal consistency. Average Variance Extracted is used to assess for convergent validity (AVE). Regarding validation of the generic framework, confirmatory factor analysis is used to assess the validity of indicators and components in each of the building blocks. All the foregoing is used to achieve the research objective to ***Perform evaluation and validation*** of ***the proposed generic framework, methodology as well as taxonomy in a real-life context of Ethiopian learning institutions***

Limitations of the study with regard to sample size was also discussed. This chapter is the foundation for the next chapter which covers data analysis and discussion of results.

7 CHAPTER SEVEN: DATA ANALYSIS AND RESULTS

7.1 Introduction

This chapter aims to analyse the data collected using the data collection instruments adopted and presented in the previous chapter. To achieve this objective, the study used Atlas.ti 9 and Microsoft excel 10 software for qualitative analysis and SPSS V-25 software with the AMOS module for quantitative analysis. Descriptive statistical techniques such as arithmetic mean and standard deviation are also used in the quantitative analysis. AMOS is used to validate the relationship between indicators and each of the building blocks of the generic framework through confirmatory factor modelling (CFM). The foregoing will help to achieve part of the research objectives **"Evaluate and validate the generic eLearning framework, a methodology for eLearning adoption and a taxonomy in a real-life context"**.

The main outcome of the chapter is to obtain feedback on the generic eLearning framework and a methodology for eLearning adoption based on analysed data and the subsequent suggestions of an improved version of the framework.

The remaining part of this chapter is organised as follows: Section 7.2 discusses data analysis methods for each of the case studies. This is followed by testing the generic eLearning framework using students' and instructors' sample in section 7.3. In section 7.4, testing a methodology for eLearning adoption is presented followed by section 7.5 which is the conclusion of the chapter.

7.2 Data Analysis Method

7.2.1 Data analysis method for validating the generic eLearning framework

The questionnaire was designed using Likert scale type (closed) questions, and the responses were analysed using quantitative descriptive statistics. Descriptive analysis can give data on company, work group, person, and other subject profiles based on a variety of criteria such as size, composition, efficiency, and preferences, to name a few. This type of analysis can be performed on a single variable, known as unidimensional analysis; two variables, known as bivariate analysis; or more than two variables, known as multivariate analysis. This researcher analysed data using SPSS V-25 statistical software with the AMOS confirmatory factor analysis module. The questionnaire also includes some open-ended questions in addition to closed questions. Expert perspectives from various research and educational institutes were also elicited using a questionnaire-structured interview guide. The questionnaire's items were mostly unstructured to

allow respondents to express themselves freely without being restricted too much. The questionnaire-structured interview guide was posted online through Google forms due to the geographical distance between the researcher and eLearning professionals. This method made gathering expert comments easier and more comfortable for the researcher, while giving experts the freedom to access the questionnaire whenever they wanted. The responses to open-ended questions and interviews were analysed using a qualitative data analysis tool called Atlas.ti version 9. This software program has been specifically designed for the qualitative analysis of large amounts of data. This researcher imported the responses to the questionnaire from Google forms directly into the software, and then used the software to generate analysis reports.

7.2.2 Data analysis method for validating a methodology of eLearning adoption

For the purpose of validating a methodology for eLearning adoption, both questionnaires and interviews were used. To analyse the collected data both qualitative and quantitative methodologies were applied. The quantitative data collected from the questionnaire through close ended questions were analysed using descriptive statistics. Descriptive research methods were used to determine to what extent the proposed methodological steps were relevant to the adoption of eLearning. Qualitative data obtained from the open-ended questions in the questionnaires and interviews were analysed using Atlas.ti version 9 qualitative data analysis software.

The outcome of the analysis produced a validated Methodology for eLearning adoption that could be used for the maturity assessment of eLearning within an institution. The suggested methodology is also intended to assist learning institutions in decision making when adopting an eLearning framework

7.3 Analysis of Data on the Generic eLearning Framework and its Key Findings

In this section, the findings of the generic framework validation in terms of assessing the measurement model tests are presented. The measurement model (CFM) was used to validate items in the questionnaires. Furthermore, the findings of generic eLearning framework validation through descriptive analysis and qualitative analysis are discussed.

7.3.1 Qualitative data analysis and findings

Atlas.ti 9 and Microsoft Excel 2010 were used to do qualitative data analysis in this research

7.3.1.1 Demographics of study participants

There were 27 participants of which, nine (33%) are experts in the area of eLearning. They are located in different parts of Africa and Europe, and are conducting research in the area of eLearning. The other 18 participants (67%), are lecturers and researchers who are experienced users of eLearning systems in Ethiopian universities. This researcher refers to these lecturers and researchers as stakeholders, and they make up the largest proportion of the participants.

- **Gender**

  Regarding gender, the majority of the study participants are male; with 23 out of the 27 participants, representing 85% of the sample being male. Only four females (15%) participated in the study, due to the difficulty in getting more female participants. Although the proportion of male participants is very large, gender difference should not inject any bias into the analysis, and therefore should not affect the results in any meaningful way.

- **Age group**

  The age distribution of the study participants is shown in Figure 7.1. The majority of the study participants (67%) are in the 25 - 40 year age group. Eight participants (30%), are in the 41-50 age range, and there is only one participant above 50 years-of-age.

  Although there is large variation in the age distribution of respondents, it should not have any influence on the result of the analysis, nor should it affect the purpose of the research.

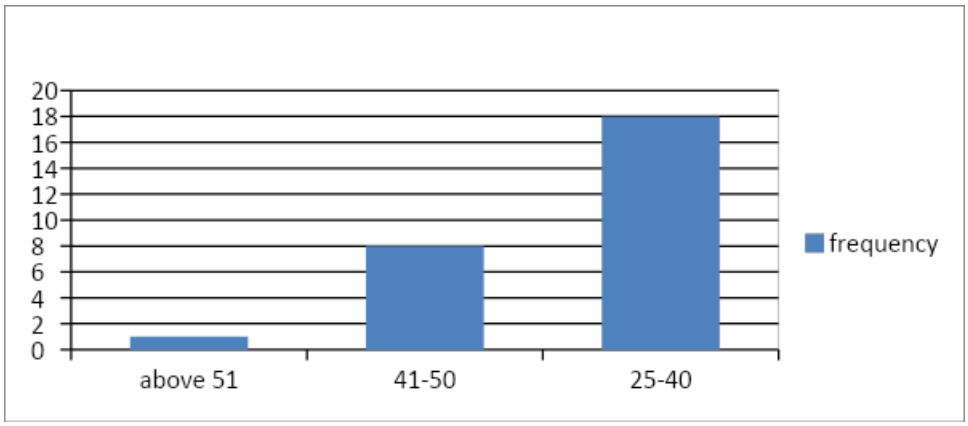

Figure 7-1:Age distribution of study participants

- **Job title**

  The majority of stakeholder participants in this research held the job title of lecturer, while the job titles of experts included professor, assistant professor, lecturer and researcher. Lecturers made up 67% (18) of the respondents, and experts (33%) of the respondents. There were more lecturers selected to be participants than experts because it was easier for this researcher to get lecturers than experts. In addition, the majority of eLearning users in Ethiopian universities are lecturers, and for this reason they were considered to be stakeholders in this study. Of the total respondents, 70% had a lecturer job title, and 11% were senior lecturers or assistant professors. There was only one professor and one researcher included in the respondents.

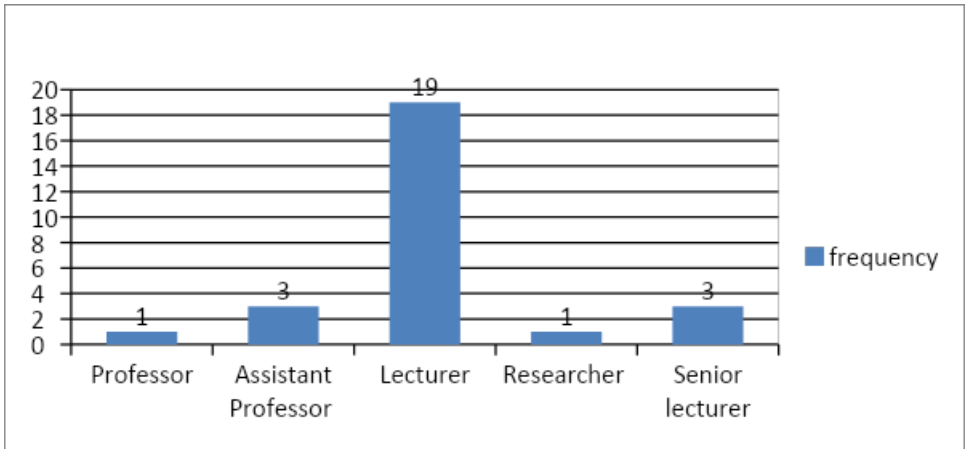

Figure 7-2:Job title distribution of study's participants

- **Work experience**

  It was essential that respondents in this study had relevant expertise and experience relating to eLearning. The majority of those selected to participate and who responded had over 11 years relevant work experience in the required field.

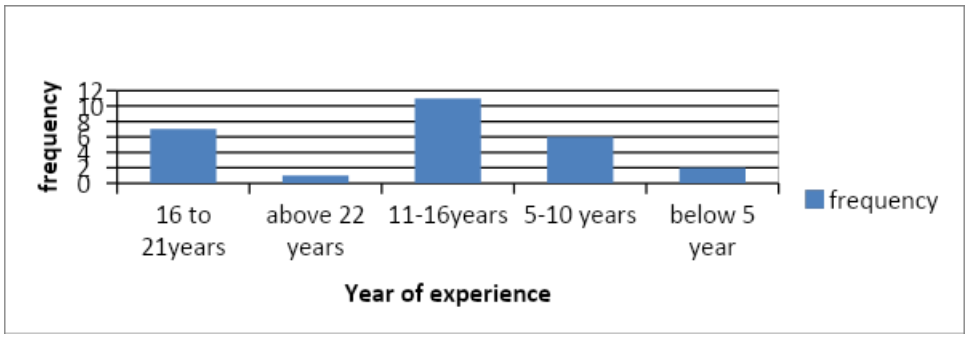

Figure 7-3: Work experience of study participants

- **Area of specialty**

  Regarding the area of specialty among the study participants, experts were expected to have ICT related specialties, but stakeholders or users of eLearning could be from any field. It was for that reason why respondents from medical science were also included in the study. Computer science and information systems specialties represented 33.3% and 26% of the total number of respondents respectively. Other specialties such as medical science made up the balance.

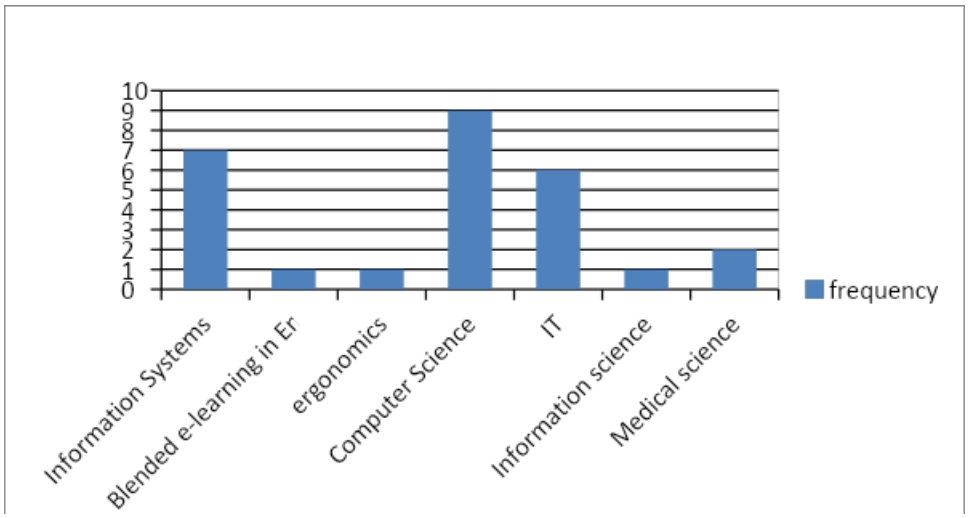

Figure 7-4: Area of specialities of study participants

- **Highest level of education**

  Of the total number of respondents, 13 held PhD degrees, which represented 48% of the total. The next highest were graduate MSc (45%) and there were two MD graduates. All respondents were highly qualified in their respective fields, and met the requirements.

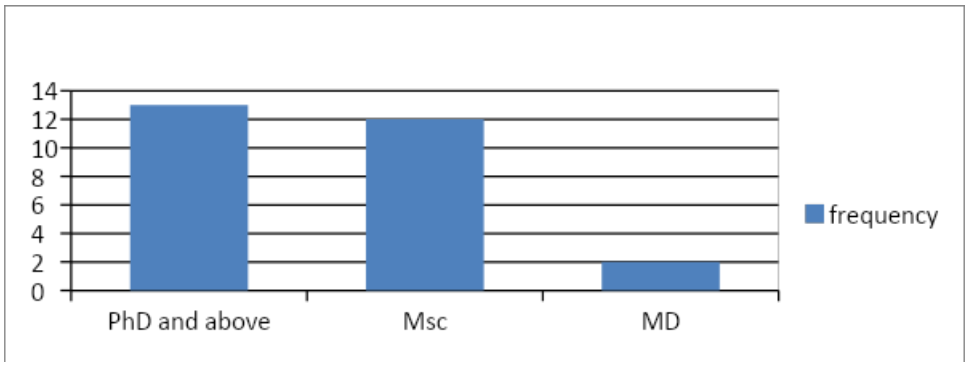

Figure 7-5: Study participants' highest level of education

Figure 7-6: Frequency level of demographic data using word cloud (source Atlas.ti)

7.3.1.2 Analysis of experts' opinion on generic eLearning framework

When asked the question "Do you agree with all the building blocks of generic eLearning framework?" Six of the experts said "yes", but three of the experts said "no". Following this question, the question "Do you think that the building blocks in the generic framework are inclusive of all the eLearning issues?" was asked of the same experts. The same six experts said "yes", but the other three said "no". The experts who answered "No" for the above-mentioned questions are also asked to provide or suggest other potential building blocks that could be appropriate for the implementation of eLearning. In line with this, only one of the experts said that the model framework presented does not show a cause-effect relationship (not a hypothesized

relationship between building blocks (nodes) and this same expert further suggest that that would be better for the researcher to review the existing literature before deciding on the building blocks of the generic framework. The other two experts, on the other hand, said that they are not clear on some of the elements of the building blocks and because of that they could not either suggest other important building blocks or could not agree that the suggested building blocks are relevant.

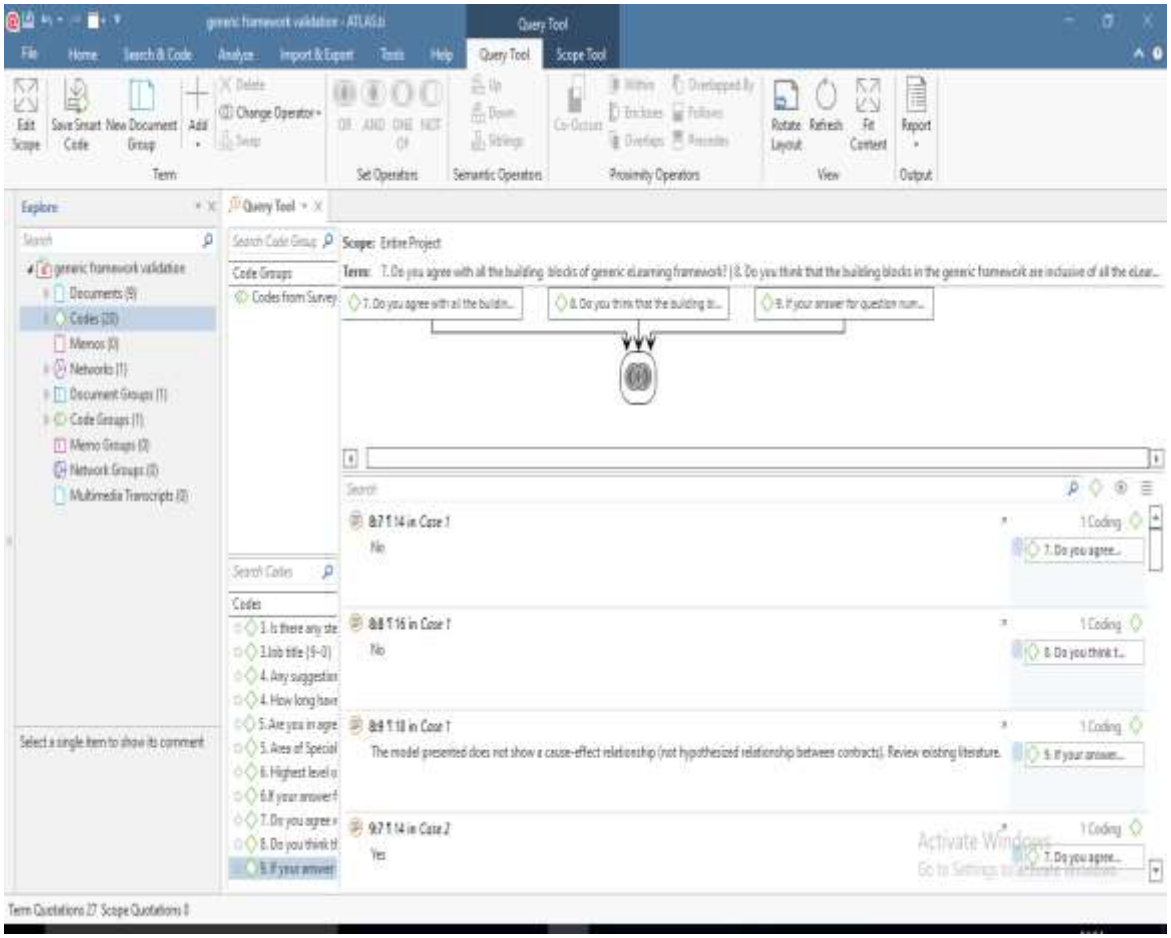

Figure 7-7: Report on validation of generic eLearning framework (source Atlas.ti 9)

Furthermore, experts are also asked to provide their opinion about the sequential arrangement of building blocks in the generic framework. When asked the question "Do you agree with the sequential arrangement of the building blocks?" Six of the respondents said "yes", but the other three said "no". Following this, the respondents, who stated 'don't agree' with the sequential arrangement of building blocks in the generic framework, were further asked to propose an alternative sequential arrangement in the generic framework. However, none of experts, who did

not agree, were backed up by any clear argument for their rejection of the proposed sequential arrangement. The results of this analysis using Atlas.ti 9, is illustrated in Figure 7.7.

Regarding the generic eLearning framework, respondents were also asked the question "Are you in agreement with the proposed artefact that makes up the generic framework, and that it can bring effective implementation of eLearning?" seven of the respondents said "yes", but the other two said "No". Following this, the two respondents who said "No" to this question were asked to give their reason. One expert did not give their reason, and the other one said that he didn't have enough information on the issue.

The respondents were then asked to give suggestions on how to improve the generic eLearning framework. Their suggestions included the following aspects:

- The interaction between or among the building blocks is missing;
- The link between or among the building blocks and the metric knowledge base should be two-way;
- Inclusion of resource support as a building block of the generic framework;
- Merging of the management block with institution; and
- The institution block should be renamed institutional readiness to indicate the constituents of that building block.

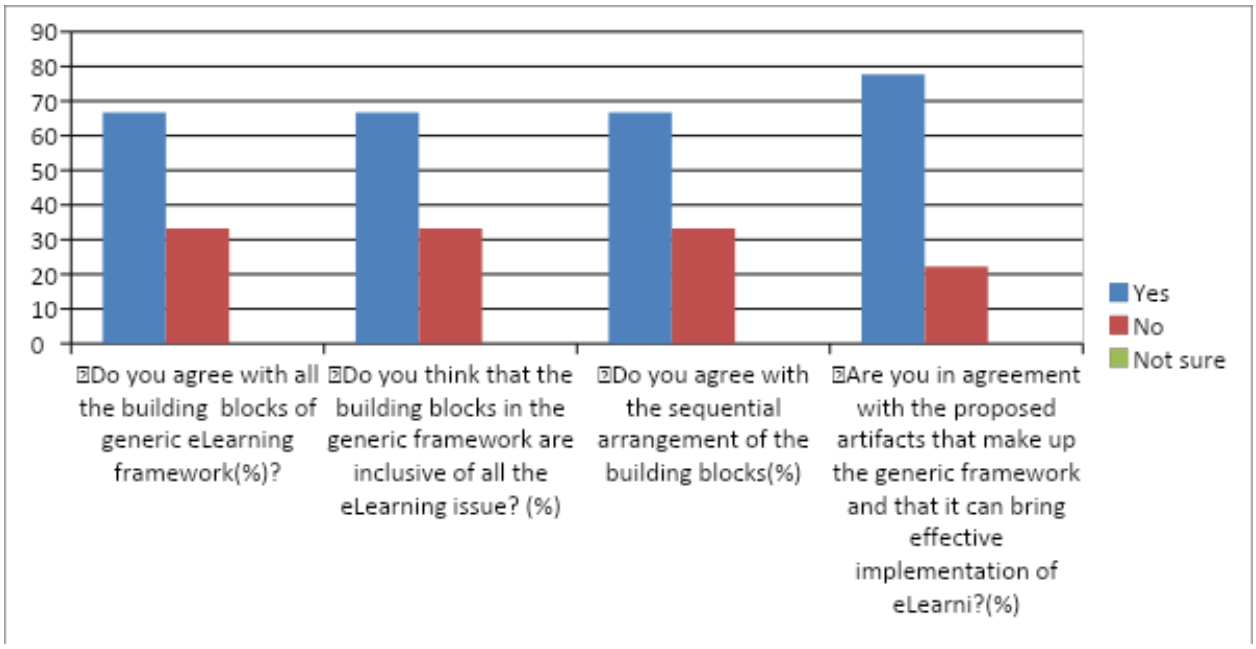

Figure 7-8: Frequency distribution of experts' response on validating the generic eLearning framework.

7.3.1.3 Analysis of instructors' (stakeholders' or users') opinion on Generic eLearning framework

Respondents, in this case, were asked to evaluate the building blocks of the generic eLearning framework in terms of their importance in the implementation of eLearning. Seven or the eighteen respondents ranked the institution building block as being of very high importance and should be given attention first. The other four respondents ranked institution either as second in importance, or as high in importance. Overall, 11 respondents; representing 61.6 %, considered institution as high importance and above and ranked it first as far as its importance is concerned.

In terms of the pedagogy building block, five respondents evaluated it as being of 'very high importance', three respondents rated it as 'high importance', and four respondents rated it of 'medium importance'. Overall, 12 respondents, representing 66.6% of the total, considered this building block to be essential. By examining the data it can be concluded that although five respondents ranked pedagogy as being the most important building block, this is less than the seven respondents who ranked the institution building block as the most important. Thus, pedagogy equates with institution in importance, though it is only by a slim margin.

The technology building block was ranked as being the third most important, with four respondents ranking it a very high importance, four ranking it as high, three ranking it as medium and two respondents ranking as being important. Interestingly, five respondents ranked technology as being less important when compared to other building blocks. This implies that respondents gave more value to other building blocks such as institution, pedagogy and management than technology. This ranking should be considered in the context of Ethiopian higher learning institutions. Respondents were also asked to reason out this issue and this will be discussed below.

The management building block was also ranked very high in importance by over 66% of the respondents. This implies that the management building block is equally as important as institution and pedagogy.

In terms of evaluation, six respondents ranked it fourth in importance, four respondents ranked it fifth, four respondents ranked it sixth, and two ranked it seventh. Only two respondents ranked it third in importance. Thus, the majority of e-respondents on average categorised it as important.

The same was also true for culture and ethics building blocks. For the culture building block, the majority of respondents ranked it from fourth to seventh in importance. Only two individuals ranked it fourth, five people ranked it fifth, and 10 ranked it sixth and seventh. As a whole, the

respondents considered culture as less important compared to other building blocks ranked from one to three. For ethics, the majority of the respondents considered it to be of low importance, with 10 people ranking it last or second to last in importance Figure 7.9 illustrates the frequency of responses on ranking the seven building blocks of the generic eLearning framework

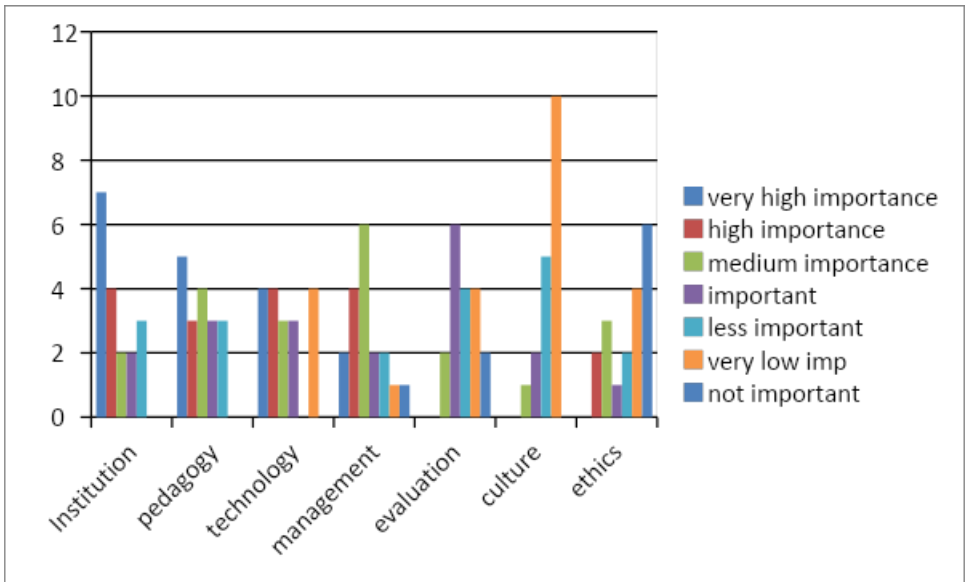

Figure 7-9: Frequency distribution on rank of building blocks

In addition, instructor respondents are also asked to explain the reason why they gave the above ranks for each factor (building blocks). Only eight of the respondents gave their reason. One of the respondents said:

> *The management is the most important factor to either enhance or diminish the implementation of eLearning within the institute, when the management is visionary and committed to any change so do the institute and the change to culture will also be there. Over all, the institute and other issues related to the institute simply resemble the top management or the leader*

This respondent tried to emphasise the role of management, both top level and middle level, in the implementation of eLearning. The point is made that if management is committed, they can bring the change necessary to implement eLearning. It is the management body or institution, in the context of the generic framework, who can initiate change.

The second respondent also pointed out:

Our eLearning is not as matured as compared with the existing face-to-face teaching and learning. So, we need to have a proper curriculum which can meet the requirement of eLearning. The institute should also have a clear understanding of the concept eLearning, its pros and cons at each management and administration level. Thirdly, eLearning is not merely a computer with Internet and accessing course repository. The technology should support different learning styles of students and should be adaptive and context aware.

This respondent emphasises the pedagogy, technology and institutional building blocks of eLearning is handled under pedagogy in curriculum development. The new curriculum should also consider learning theories and the technology at hand. It is under pedagogy that the questions how, what and to whom a course is delivered, are expected to be answered. Both the course development and the delivery tool (technology) should be seen from the perspective of pedagogical principles. This respondent also emphasises the importance of arranging awareness creation programmes and training so as to make users, including top and middle level managers, very familiar with the what of eLearning and how to use it. Through training, managers can easily be motivated and motivate others. This can also be achieved through motivational trainings, incentives, funds etc. arranged by the institution.

Another respondent also emphasises institution, management, pedagogy and technology building blocks by stating the following:

The institution should take the lead in implementing eLearning by designing policy including the management and the pedagogical aspect needs to be considered with the learning theory appropriate for the course. The curriculum should also consider the technology at hand; it should support the course delivery and development. So that the issue such as, institution, pedagogy and management are given high priority and then technology will follow. Ethics and culture might not have given as such a great emphasis in the cyber community as compared to the others, but still they shouldn't be overlooked.

Similarly, a respondent also provided the following opinion about why the above rank was given.

> *Institutional, management and technology are major factors for the introduction and implementation of eLearning, whereas ethics and culture may not be among the major contributing factor. The curriculum used in the traditional mode can also be adapted for eLearning purpose.*

On the other hand, one of the respondents said that:

> *Without technology, we can't talk about other building blocks. Thus, I gave the first rank for technology as far as its importance is concerned as compared to other building blocks.*

Another three respondents said, all the building blocks mentioned in the generic framework are good in the implementation of eLearning.

Lastly, the instructor respondents were also asked to list any other factors they thought could affect eLearning, and which had not been included in the proposed generic eLearning framework. The majority of these respondents (72.2%) said all factors had already been included in the proposed generic framework. However, five instructors suggested some additional factors that could be considered when implementing eLearning.

One of these respondents mentioned the importance of knowledge, attitude, and awareness as other factors for the implementation of eLearning. Another respondent also said inspiring users through frequent and organised exhibitions should be given emphasis as a factor of eLearning.

Furthermore, another respondent said the infrastructure system should be considered, and that a room equipped with computers was not enough.

The importance of technical support and a dedicated support team was also emphasised by one of the respondents, who said:

> *Additionally, the eLearning system should be backed up with a power supply during electrical power interruptions. A computer lab attendant who stands by during exam, and dedicated support team for instructors and student, should be established.*

Another respondent also emphasises the importance of managing (monitoring, controlling) the eLearning activity by saying:

> *One of the most important factors in eLearning are negligence of teachers and lack of monitoring by leaders, especially Department Head and College Dean*.

The last respondent emphasises training and pedagogical issues by saying: "There is lack of awareness about use of eLearning and lack of concern about educational quality. More priority is given to financial allocation for infrastructure than the teaching-learning process."

7.3.1.4 Key findings on validating the generic eLearning framework

This section discusses the key findings on the process of validating the generic eLearning framework. This was achieved through qualitative data analysis.

Over 66% of experts and 72% of eLearning users agreed that the building blocks suggested in the generic eLearning framework were all inclusive and important for implementing eLearning effectively. Apart from supporting the building blocks suggested, the respondents wanted to give emphasis to some of the components and elements of the building blocks and they also suggested some alternative names for some of the building blocks.

According to the respondents, it was necessary to develop a new curriculum for eLearning so as to bring in educational quality that cannot be achieved in a traditional mode of learning. The new curriculum should also consider the learning theories and the technology at hand. The organising of awareness creation programmes such as exhibitions and training, to familiarise users with eLearning and how to motivate them to use eLearning systems are equally important as other eLearning factors. Thus, although curriculum related issues are included in pedagogy and the motivational issues are considered under institution building blocks of the generic eLearning framework, the respondents emphasised these as matters of importance.

The research also indicated that some respondents misunderstood the difference between the management and institutional building blocks. The respondents considered the management block to be the management body of the institution and suggested that it would be more appropriate for the institution building block. In line with this, the respondents emphasised that institutional readiness, or commitment of the management body, is the key that enables other factors work effectively. The institutional readiness block includes the preparation of policy, arranging training and other related issues. The management body should also be aware of the pros and cons of eLearning; this body should be familiar with eLearning so that the commitment and creating loyalty to the system would follow. Consequently, for the improved generic eLearning framework, the institution building block was renamed the institutional readiness block. Similarly, the management block was renamed the information management block.

With regard to technology, the respondents stated that universities today place emphasis on technology and infrastructure, but not on the quality of content that is being delivered by the technology. They suggested that quality of delivered content should be give equal attention to the technology infrastructure.

Another finding from the qualitative analysis raised questions about controlling and monitoring eLearning use. The key question was whether instructors and learners were using the system, and if so, was the system being used correctly. The feeling was that proper use should be incentivised and improper use should be punished. As a result of this finding the evaluation block was renamed the monitoring and evaluation building block, so as to give attention to the monitoring activity in addition to evaluation.

Regarding ethics and culture, the respondents recognised their importance for implementation of eLearning but felt that they were not as important as the other building blocks. While ethics and culture are important, they are not the current issue, especially in developing countries like Ethiopia. It seems that these two building blocks are not among the priority issues in developing countries even though culture of learners affects ways of teaching, content delivered, and tools of delivery. Although eLearning content and tools should address the need of diverse learners, treating diversity may not be the priority issue. It is undeniable that culture and ethics affect the technology and pedagogy building blocks, but according to the respondents, they may not be priority issues.

With regard to the sequential arrangement of building blocks in the generic eLearning framework, respondents suggest that institution building block should take the lead. Over 56% of the respondents indicated that the institution, pedagogy, technology and management building block were very important in the implementation of eLearning, ranking them from 1 to 4 respectively. Furthermore, the findings suggested that the connection between the seven blocks and the metrics knowledge base should be two-way. The knowledge from the building blocks will be the input to the metrics knowledge base and the knowledge in the metrics knowledge base will also be referred to by the seven building blocks for evaluation.

7.3.2 Quantitative data analysis for further validation of the generic eLearning **framework**

Earlier in this section, confirmatory factor analysis was used for validating the measurement model. It was applied so as to understand to what extent lower-level components were related to higher-level building blocks. The relationships between observed variables (components) and

building blocks were determined based on the findings of the empirical data. Descriptive statistics were then used to validate the generic eLearning framework.

Indent bullets as previous section above

7.3.2.1 Validating the generic eLearning framework over students' sample

Straub et al., (2004) points out that the data must be reviewed for outliers, normality tests, missing data and questionable response patterns before moving on to the data analysis procedure. Consequently, before moving on to the data analysis part, this section explains the procedures used to determine and manage the data set's quality.

- **Data outlier**

  As the respondents had a good understanding of the subject of the questionnaire, no data outliers occurred. The respondents had been using the eLearning system for more than three years. Therefore, they were familiar with the questions and as a result, there were no odd answers, or no single answer for two different questions in any of the questionnaires.

- **Missing values**

  Missing values occur when respondents do not answer questions in the questionnaire. According to Hair et al. (2013), the proportion of missing values in a specific questionnaire in relation to the observed data may have an impact on bootstrapping. As a result, they established a threshold value of less than 15% per each indicator in the questionnaire data as an acceptable number. Any questionnaire that fails to meet this criterion should be removed from the data analysis process. There were no missing values in the Likert-scale type questions due to the careful data collecting processes and small sample sizes utilized in this study, however there were some in the essay type questions. Since the researcher used the essay type questions for triangulation purpose, no questionnaire was removed from the data analysis.

- **Data collection tools**

  Four basic data collection tools were used in this research: questionnaires, interviews, document analysis, and observation. The survey questionnaire was created using the concept of building blocks and their components as described in the literature. The questionnaire was divided into two parts: the first was used to gather demographic information, and the second was used to determine how respondents felt about the importance of the building blocks and their components in the successful implementation of eLearning. The survey's questionnaire comprised of five-point Likert type scale

questions that probed students', instructors', and administrators' attitudes and views about the suggested building blocks. Few essay-style questions were used for cross checking and triangulation. In addition, some interviews were conducted to triangulate the findings.

Sample size and distribution

This researcher distributed questionnaire to 80 students and 20 instructors or administrators who were directly involved in the eLearning activity. The selection was made by top level management. Since eLearning was only practiced in few of the departments, this researcher was able to get this number of respondents only from the four universities specifically selected for this research.

Table 7-1: Student respondents' sample size for validating the generic eLearning framework

Name of universities who best implement eLearning at the current time	Student sample	Instructor and admin sample
Arba Minch university	32	8
Jimma university	38	8
Adama university	---	2
Civil service university	10	2
Total	**80**	**20**

7.3.2.2 Demographic data on student respondents

- **Gender distribution of respondents**

  Majority of the respondents were male (65%) and the balance were female or sex not mentioned (35%).

- **Educational status of respondents**

The majority of respondents for this study have a degree qualification; 90% of the respondents were attending their degree, and 10% were attending their MSc or PhD. They were selected because they were the ones involved in eLearning practice.

Table 7-2: Educational status of respondent students for validating the generic eLearning framework

Frequency Table

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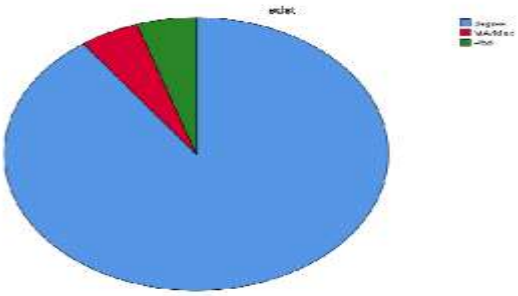
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	degree	72	90.0	90.0	90.0
	MA/Msc	4	5.0	5.0	95.0
	Phd	4	5.0	5.0	100.0
	Total	80	100.0	100.0	



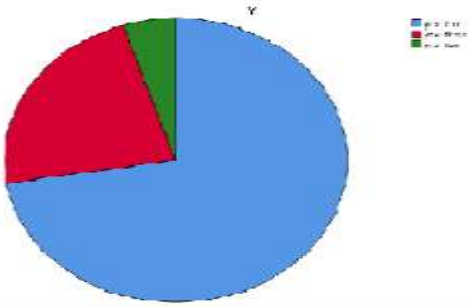
- **Year of study**

  According to year of study distribution, 72.5% of the respondents were seniors in their fourth year of study, 22.5% of the respondents were in their third year of study and 5% were in their second year. Introduce the table 7-3 below

Table 7-3: Students' year of study for validating the generic eLearning framework

Y

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	year four	58	72.5	72.5	72.5
	year three	18	22.5	22.5	95.0
	year two	4	5.0	5.0	100.0
	Total	80	100.0	100.0	



7.3.2.3 Validating the measurement model

According to Hair et al., (2016) and others, the assessment results of a measurement model are evaluated in terms of uni-dimensionality, convergent validity, discriminate validity and internal consistency reliability. In this research MS Excel, SPSS with AMOS software was used to

calculate and determine results of the constructs' reliability and validity. In this research, there are seven building blocks or constructs. The reliability and validity test of these constructs are displayed in the tables and figures below.

Construct reliability of the measurement model was measured using vigorous reliability tests. Accordingly, the reliability test should fall within the given threshold values: Cronbach's alpha value greater than 0.70 (Pillai, 2020) and Composite Reliability value greater than 0.70 (Hair et al., 2013). Similarly, convergent validity test of the measurement model should fall within the recommended threshold value as measured in terms of Average variance Extracted (AVE) greater than 0.50. Tables 7-11&7-14 below present the overall reliability and validity test results of the study's construct.

- **Confirmatory factor model**

  Confirmatory factor model (CFM) was conducted to specify and validate the underlining indicator variable in each of the building blocks of the generic eLearning framework (institution, pedagogy, technology, management, culture, evaluation and ethics). The CFM specifies the relationship of observed indicator variables to each of the building blocks in the generic eLearning framework. The model aims to describe how well the indicator variables determine the latent variable that is the corresponding building block, in the generic eLearning framework, or how well the indicator variable serves as a critical measurement of the building blocks in the generic eLearning framework. SPSS AMOS version 25 was used to calculate factor loading of each indicator variable towards the latent variables (building blocks) and to calculate model fit index. For instance, Figure 7.10 indicates the seven indicator variables (from I7 to I14) proposed to measure the institution building block. Standardised validity coefficient values (standardised factor loading) are also generated in the analysis that are showing high validity. The outputs generated by AMOS through CFA, including the factor loadings, suggests that there is moderate fit of the model. Indicator variables are significantly loaded to the latent variable institution since the entire loading passed significant test. The non-significant Chi-square test and RMSA value of less than 0.05 or 0.08 are good indicators of model fit index. Besides the value of CFI, NFI, TLI indexes that are above 0.95 are good indicators of model fix.

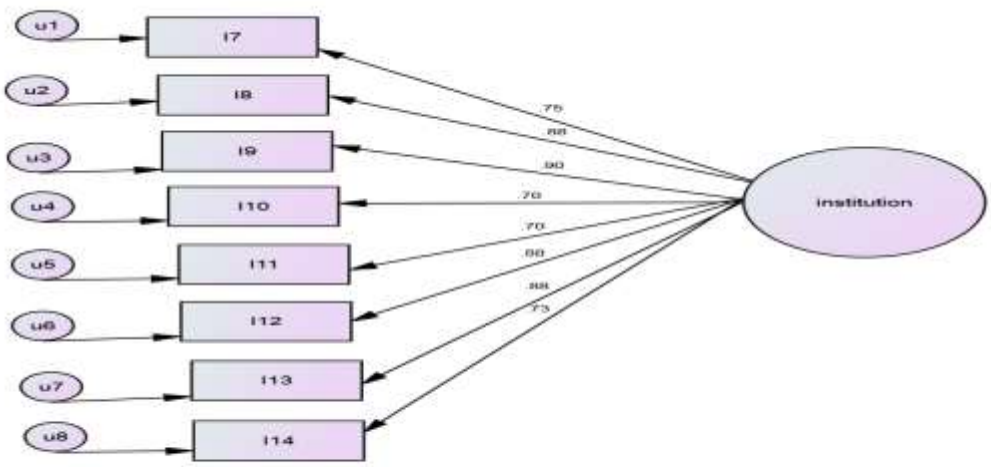


Figure 7-10: Factor loading on indicators and institution building block

Table 7-4: Regression weights on institution building block (Source AMOS)

	Estimate	S.E.	C.R.	P	Label
I7 <--- institution	1.000				
I8 <--- institution	1.423	0.172	8.261	***	
I10 <--- institution	1.049	0.163	6.437	***	
I9 <--- institution	1.444	0.168	8.582	***	
I13 <--- institution	1.256	0.151	8.320	***	
I11 <--- institution	1.133	0.178	6.366	***	
I12 <--- institution	1.549	0.187	8.274	***	
I14 <--- institution	1.166	0.173	6.755	***	

The CFI, NFI, TLI values are also above 0.9 that is acceptable goodness of model fit

Table 7-5: Regression weights on pedagogy building block (Source AMOS)

	Estimate	S.E.	C.R.	P	Label
P2 <--- Pedagogy	1.000				
P3 <--- Pedagogy	0.764	0.104	7.316	***	
P4 <--- Pedagogy	0.819	0.093	8.831	***	
P5 <--- Pedagogy	0.915	0.094	9.698	***	

The CFI, NFI, TLI values are above 0.95 that is considered a ‘pretty good’ of model, firmest value is also below 0.0

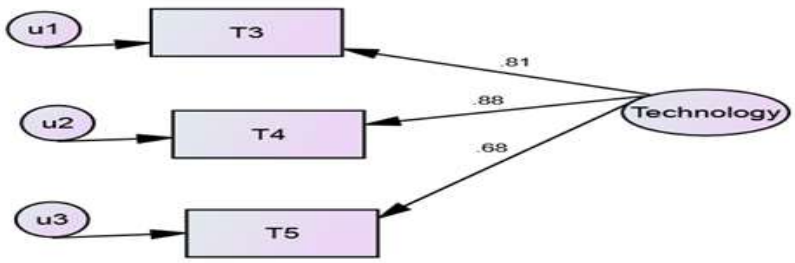


Figure 7-11: Factor loading on technology building block and its indicator variables (Source AMOS)

Table 7-6: Regression weights on technology building block (Source AMOS)

	Estimate	S.E.	C.R.	P	Label
T3 <--- Technology	1.000				
T4 <--- Technology	1.014	0.151	6.694	***	
T5 <--- Technology	0.724	0.120	6.012	***	

The CFI and NFI values are also above 0.95 that is a 'moderately good' model fit.

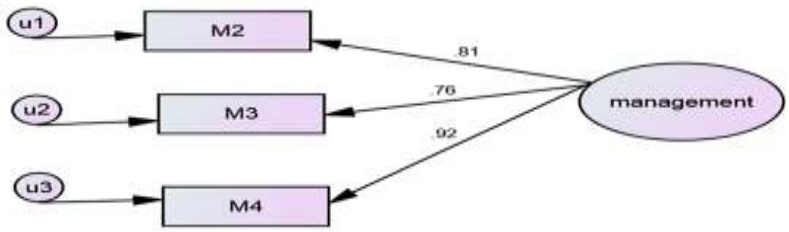


Figure 7-12: Factor loading on management building blocks and its indicator variables (Source AMOS)

Table 7-7: Regression weights on management building block (Source AMOS)

	Estimate	S.E.	C.R.	P	Label
M2 <--- management	1.000				
M3 <--- management	0.925	0.126	7.333	***	
M4 <--- management	1.304	0.161	8.106	***	

The CFI and NFI values are also above 0.95 that is a 'moderately good' model fit.

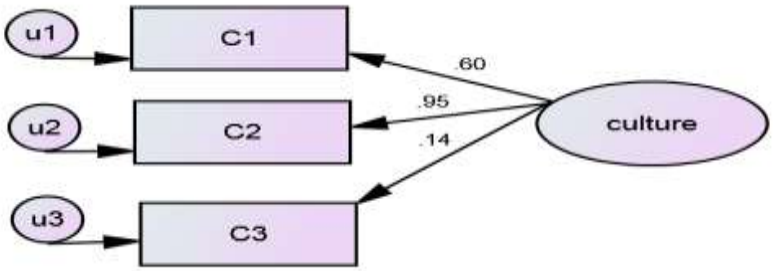


Figure 7-13: Factor loading on culture building block and its indicator variables (Source AMOS)

Table 7-8: Regression weights on culture building block (Source AMOS)

	Estimate	S.E.	C.R.	P	Label
C1 <--- culture	1.000				
C2 <--- culture	1.510	1.631	0.925	0.355	
C3 <--- culture	0.247	0.207	1.196	0.232	

Furthermore, The CFI and NFI values are above 0.95 that is a moderately good model fit.

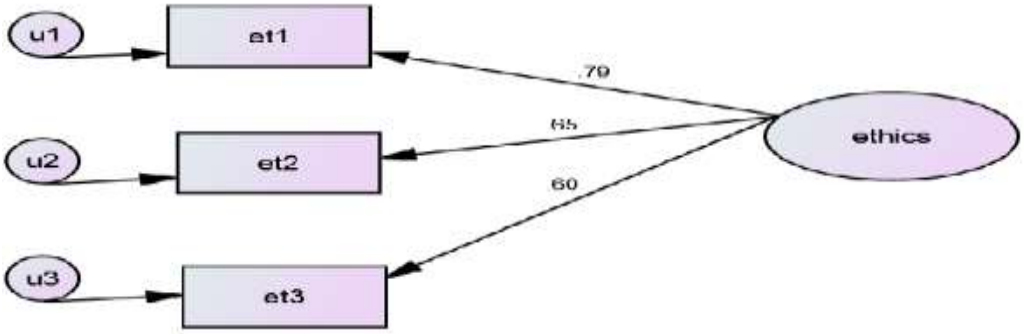


Figure 7-14: Factor loading on ethics building block and its indicator variables (Source AMOS)

Table 7-9: Regression weights on ethics building block (Source AMOS)

	Estimate	S.E.	C.R.	P	Label
et1 <--- ethics	1.000				
et2 <--- ethics	0.894	0.234	3.821	***	
et3 <--- ethics	0.609	0.162	3.759	***	

Furthermore**,** the CFI and NFI values are above 0.95 that is a 'moderately good' model fit.

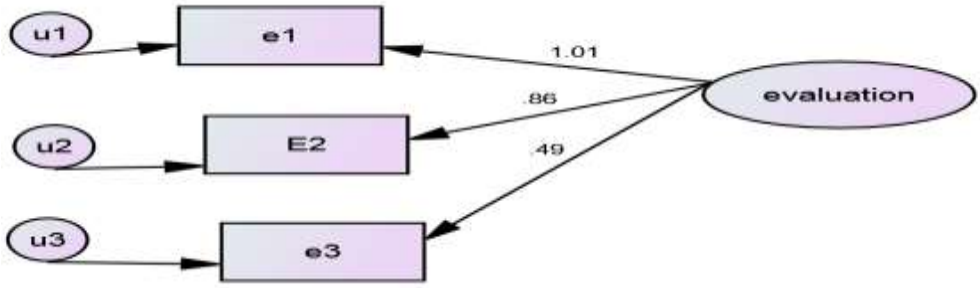


Figure 7-15: Factor loading on evaluation building block and its indicator variables (Source AMOS)

Table 7-10: Regression weights on evaluation building block (Source AMOS)

	Estimate	S.E.	C.R.	P	Label
e1 <--- evaluation	1.000				
E2 <--- evaluation	0.852	0.226	3.768	***	
e3 <--- evaluation	0.380	0.177	2.142	0.032	

Furthermore, the CFI and NFI values are above 0.95 that is a 'moderately good' model fit. Based on the above confirmatory factor analysis results, the overall validity and reliability test results are shown in the table below.

Table 7-11:Reliability and validity test results over student's data for validating generic eLearning framework

Building blocks	Cronbach's alpha measure	Composite reliability	Average variance extracted
Institution	0.93	0.937	0.651
Pedagogy	0.88	0.889	0.668
Technology	0.83	0.835	0.630
Management	0.86	0.872	0.696
Culture	0.72	0.627	0.429
Ethics	0.71	0.720	0.468
Evaluation	0.82	0.849	0.669

- ***Validating the generic framework over instructors' sample***
  - **Data outlier**

    The respondents had been using the eLearning system more than three years. Therefore, they were familiar with the questions and no odd answers or no one answer for two different questions and vice versa occurred. Hence, there are no data outliers.
  - **Missing value**

    Only missing values in the questionnaire data of less than 15% per indicator variable are allowed. The questionnaire must be eliminated from the data analysis procedure if this is not the case. Missing values were less than 15% due to the careful data collecting technique and small sample sizes employed, except in the case of essay type questions were some missing values were observed. Since this researcher uses the essay type questions for triangulation purpose, no questionnaires were removed from the data analysis.
  - **Sample size and distribution**

    The questionnaires were distributed to 20 instructors based on the experience that they have in the practice of eLearning. Table 7.12 presents the sample size and distribution.

Table 7-12: Instructor respondents' sample size for the validation of generic eLearning framework

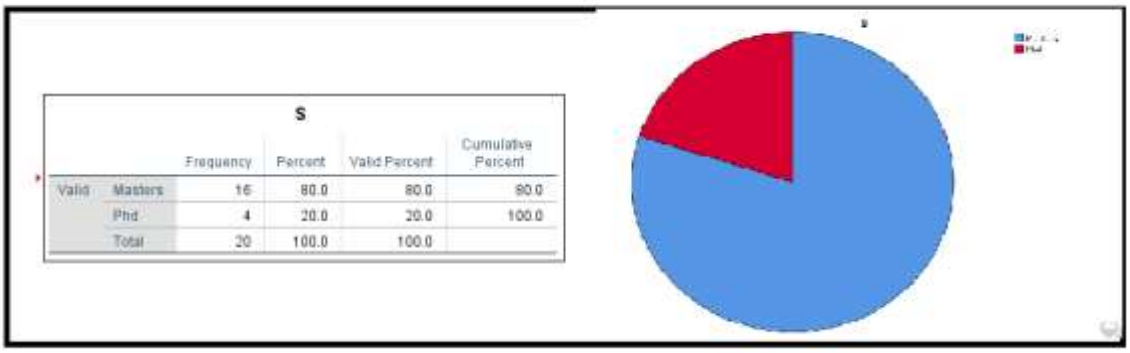
Name of universities	**Instructor and admin sample**
Arba Minch university	8
Jimma university	8
Adama university	2
Civil service university	2
Total	20

- ***Respondents' demography***
  - **Instructors' Gender distribution**

    Of the overall instructor respondents, 95% of the instructors are men and the remaining 5% are women. However, gender variation does not affect the result of the analysis.
  - **Distribution of instructors' educational status**

    Majority of the instructor respondents' (80%) have a Masters' qualification. The rest (20%) have a PhD qualification.

Table 7-13: Instructors' educational status for validating the generic eLearning framework



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		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Masters	16	80.0	80.0	80.0
	Phd	4	20.0	20.0	100.0
	Total	20	100.0	100.0	

- ***Validating the measurement model over instructors' data***

The result of confirmatory factor analysis over instructor data also shows that there is strong relationship between the building blocks and their indicator variables since the average factor loading results registered are above 0.6 which is a good indicator of relationship. Above all, the NFI, IFI and CFI values are also above 0.95 and also indicators of model fit. Based on the confirmatory factor analysis, the following overall reliability and validity test results were generated. The entire table below shows the test results that are beyond the threshold values.

Table 7-14: Reliability and validity test results over instructors' data for the validation of generic eLearning framework.

Building blocks	Cronbach's alpha measure	Composite reliability	Average variance extracted
Institution	0.8	0.874	0.54
Pedagogy	0.92	0.929	0.725
Technology	0.92	0.933	0.741
Management	0.7	0.7	0.529
Culture	0.9	0.637	0.468
Evaluation	0.82	0.858	0.669
ethics	0.95	0.890	0.730

- ***Quantitative analysis on validating the generic eLearning framework***

  The data collected for the purpose of validating the generic eLearning framework was also analysed using descriptive statistics (mean and standard deviation). The building blocks were assessed using a descriptive research method to see how relevant they were to the acceptance of an eLearning framework, and therefore establishing the foundation for the adoption and implementation of an eLearning platform. The surveys were created to collect demographic as well as attitudinal data. Although the respondents' demographic data attribute such as gender, educational background and socioeconomic status varied significantly, the results of the questionnaires did not demonstrate any significant differences as a result of the respondent's demographic.

  The respondents were also asked about their thoughts on the significance of the generic framework's building blocks and components. The questions in the attitude part of the surveys were designed to extract students', teachers', and administrators' attitudes toward technological, institutional, pedagogical, cultural, ethical, evaluation and management readiness. In this regard, some differences in results were seen between students and instructors/administrators as shown in Table 7.15. The tables present some of the information gathered from students, instructors, and administrators about the usefulness of the building blocks and components. In the scale, variables with a mean value close to 5.0 represented "strongly agree," those with a mean value between 4.0 and 3.0 represented

"agree" and "neutral," and those with a mean value close to 2.0 represented "disagree," and those with a mean value below this represented "strongly disagree." Standard deviation was also used to measure the variability of the answers. In the table, the mean result of the responses in each building block is displayed in the form of a range; for example, there are 11 questions in the institution block, and the mean of the responses for each building block is computed; ultimately, the lower mean and upper mean are taken for illustration purposes. The mean under each building block is more than 4.00, as seen in the table. This indicates that the respondents agreed on the issues raised under each building block. For example, the respondents agreed that the institution should be prepared by providing students, professors, and administrators with the essential training. The respondents also agreed that the eLearning system should support libraries, bookstores, and counselling services; though the importance of the building blocks was emphasised more by instructors and administrators than students. Regarding the respondents from different institutions, there was no significant variation shown in the results. Cronbach's Alpha coefficient, one of the most common markers for verifying internal consistency, was also used to assess the constructs' overall reliability; the desired coefficient should be larger than 0.7 (Hair et al.,2013). This study's Cronbach's Alpha coefficient is 0.88. This value is more than 0.7, indicating that the constructs are highly reliable.

To summarize, almost 90% of respondents agreed that all of the building blocks were important. They also included other key recommendations for eLearning deployment, including instructor motivation and perceptions of technology, persons who manipulate the system, and proper WIFI connectivity, to name a few.

Table 7-15: Quantitative analysis of questionnaire data on validating the generic eLearning framework

Building blocks	Students		Instructors and administrators	
	Mean	Std. Dev.	Mean	Std. Dev.
Institutional (e.g. I believe that institutions should be ready in many aspects like giving training for instructors and students, giving technical support to both students and teachers in eLearning matters.)	4 to 4.40	0.9 to 1.484	4 to 5.00	0.000 to 1
Pedagogy (e.g. I feel there should be a balanced presentation of ideas and appropriate level of detail for a course in the eLearning system.)	4 to 4.27	0.97 to1.017	4 to 4.89	0 to 0.323
Technology (e.g. I feel the application software/eLearning system should contain different aesthetic/user friendly features)	4 to 4.2	1 to 1.212	4 to 4.89	0 to 0.323
Management (e.g. I believe that there should be clarity of announcements, schedule and course relevant contact in the eLearning system)	4.06 to 4.1	0.9 to 1.2	4 to 4.78	0 to 0.428
Culture (e.g. I believe that use of icons, jargon, idioms, ambiguous or cute humour, and acronyms that may mean different in different culture should be avoided in the eLearning system.)	4 to 4.5	0 to 0.913	4 to 4.56	0.3 to 0.784
Ethics (e.g. I believe that the eLearning system should support mutual respect policy in case of discussions, privacy and plagiarism policy)	4.16	0 to 0.947	4 to 4.78	0.428 to 1.2
Evaluation (e.g., I believe that the eLearning system should support evaluation of learning and learning environment, content development processes, institutional eLearning program and individuals involved in content development)			4 to 4.67	0 to 0.485

7.3.3 Improved generic eLearning framework

An analysis of the results of the research has initiated an improved version of the generic eLearning framework, and methodology for eLearning adoption. In the new version, some of the building blocks have been renamed, so as to create clarity of scope and to give emphasis to some of the components of the building blocks in the eLearning framework. The improved generic eLearning framework is illustrated in Figure 7.16 below.

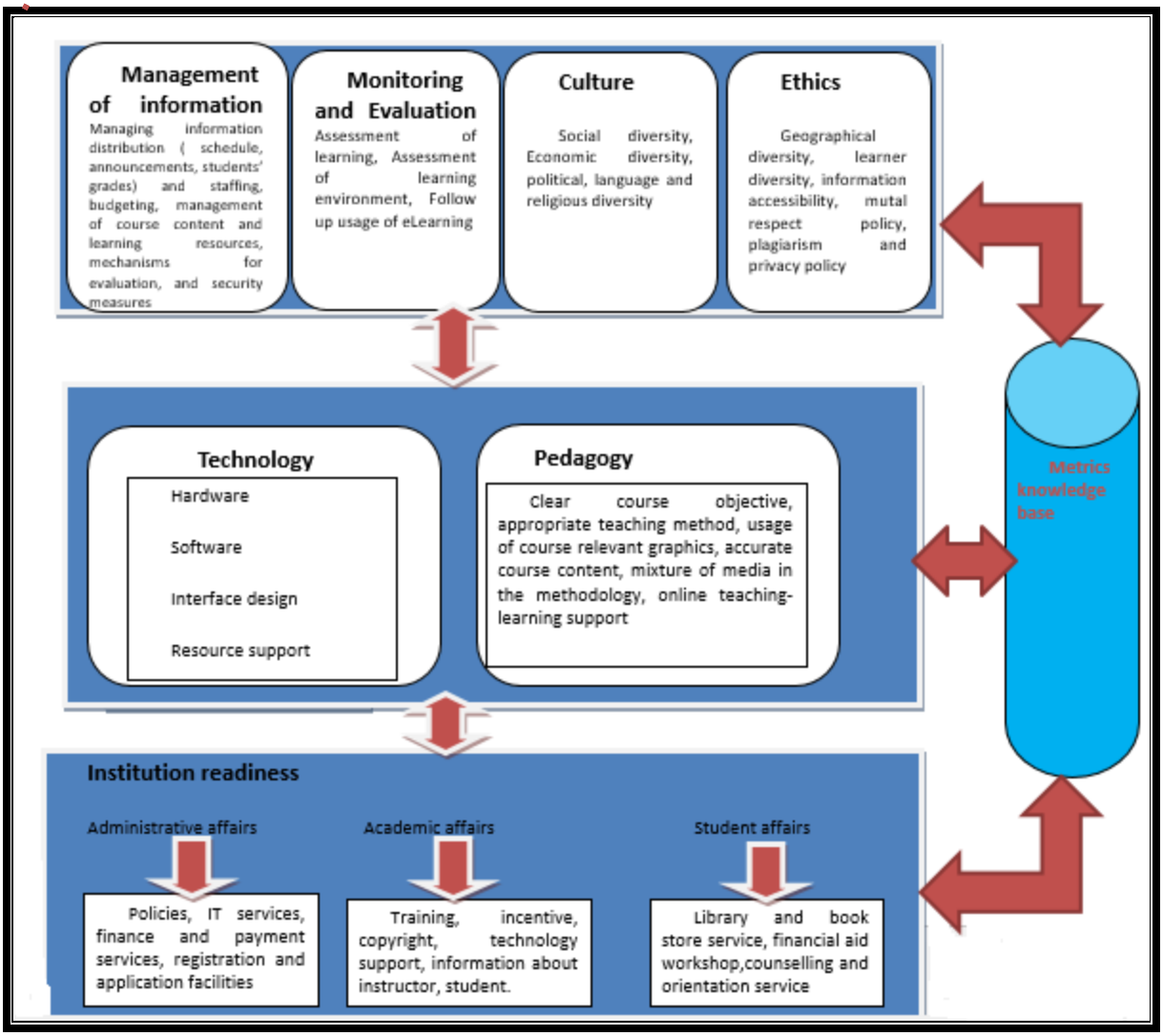


Figure 7-16: Improved generic eLearning framework

While the original version of the generic eLearning framework was well inclusive, the findings of the qualitative study suggested that three building blocks should be renamed, and the linkages between the building blocks and the metrics knowledge base should be more clearly defined. Three building blocks have been renamed, and are discussed in more detail below:

- The **management** building block has been renamed as information management. This change has been made to reflect the fact that it is information that is managed in this block, and not human resources, or other organisational resources, which are managed under the institution building block. The information management building block is about managing information flow and use of the eLearning system from an information perspective.

- The **institution** building block has been renamed as institutional readiness to provide clarity to the user and clearly determine the scope of the building block. This change has been made to address the confusion some respondents had of the difference between the management and institution building blocks. The institutional readiness building block is concerned with preparing the organisation as a whole for the implementation of eLearning.
- The **evaluation** building block has also been renamed as monitoring and evaluation building block since respondents emphasised that monitoring the use, and users, of eLearning is also important in order to achieve effective implementation of eLearning. Thus, respondents believed there should be a mechanism to monitor eLearning users to determine to what extent they apply eLearning in the teaching-learning process. Users of the eLearning system, particularly the instructors, should be evaluated to see whether they are using the system as intended.
- Furthermore, respondents suggested that there should be **iteration** between and among the metric knowledge base and the seven building blocks. The metrics knowledge base is updated from the seven building blocks, and the building blocks need to access the metrics in the knowledge base in order to evaluate their performance and determine maturity levels.

7.4 Analysis of Data on Validating a Methodology for eLearning Adoption

7.4.1 Qualitative data analysis

- ***Analysis of experts' opinion on validating a methodology for eLearning adoption***

  For the question: "Do you agree with all the steps of a methodology for eLearning adoption?" Eight of the respondents said that they agreed with the steps of a methodology. Only one said that they 'did not agree', and the other two were 'unsure'. When asked to give a reason for their negative answer, the respondent said that they felt the underlying reason to propose the methodology had not been described, and as a result they were not able to give feedback.

  The question "Is there any step that is important but not incorporated in the above methodology?" was answered as 'yes' by six (66.6%) of the respondents. On the other hand, two of the respondents answered 'no' and only one was neutral. This finding is shown in the Figure7-17, extracted from Atlas.ti 9.

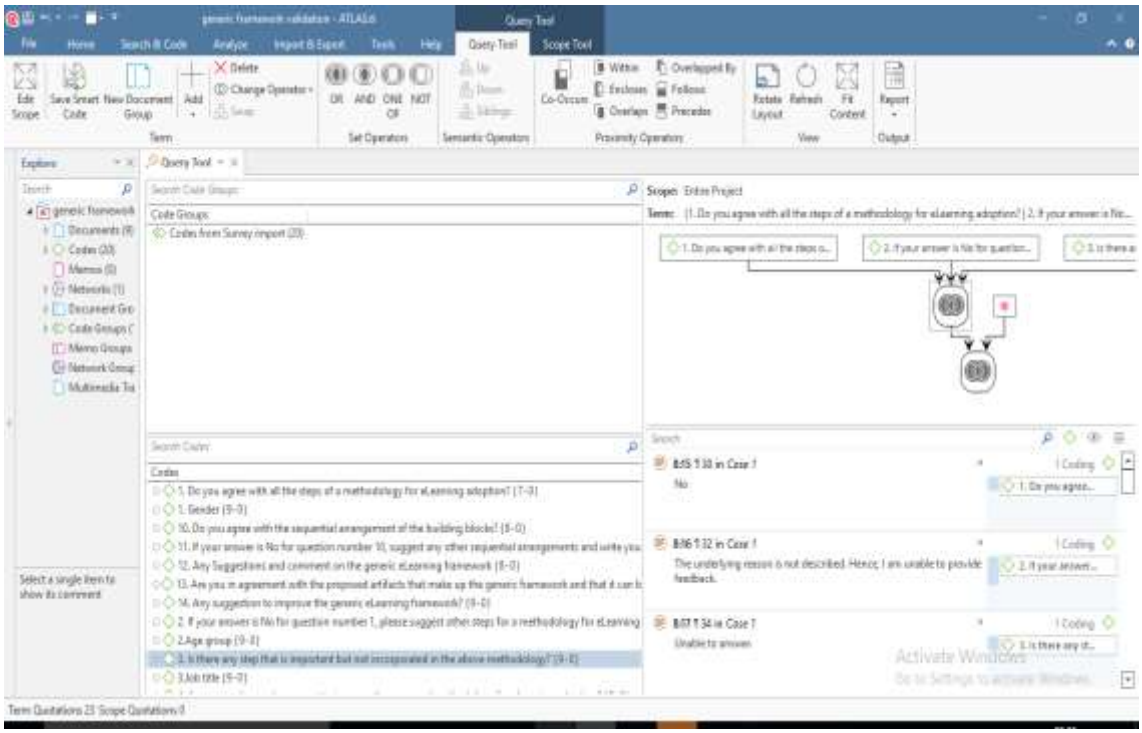


Figure 7-17: Expert's validation of a methodology for eLearning adoption (source Atlas.ti 9)

Furthermore, the respondents were asked the question "Are you in agreement with the proposed artefacts that make up a methodology for eLearning adoption and that it can bring effective adoption of eLearning?" Six of the respondents, answered 'yes', but the rest answered 'no'. In line with this, the respondents who said 'no' were asked to provide their reasons. Two of the respondents said that there was insufficient information about the methodology and that was their reason for their negative answer.

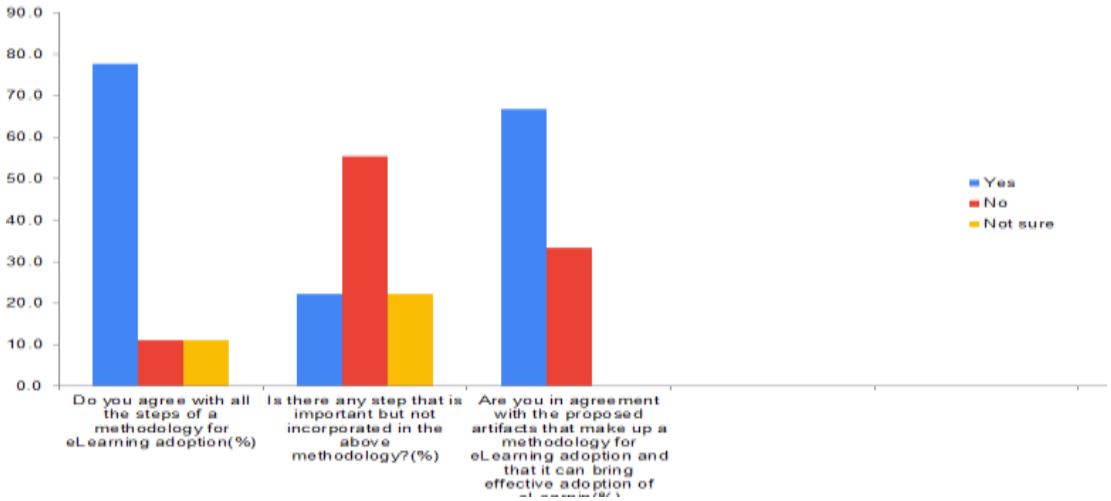


Figure 7-18: Frequency of responses on validation of the methodology.

Finally for the question, "Any suggestion and comment to improve the proposed methodology for eLearning adoption?", one respondent suggested starting with existing models that were based on sound research and published papers, and another suggested that the process should show iteration to the first step of the model.

- ***Analysis of eLearning users' opinion on validating a methodology for eLearning adoption***

The respondents were asked to propose additional steps (if any) to be considered in the process of eLearning adoption. However, no new steps were suggested, and most of the proposals made had already been incorporated into process. Over 50% of the respondents mentioned activities that should be incorporated in the maturity assessment phase for existing eLearning frameworks. According to the respondents, the following activities should be given priority in the process of eLearning adoption:

- Raising awareness about the benefit of eLearning and the responsibilities of staff towards eLearning,
- Providing the necessary training for eLearning users on how to use eLearning system,
- Providing incentives for users of eLearning,
- Establishing sustainable infrastructure and power supply, and
- Development of eLearning policies and curriculum (this last item was mentioned by the majority of respondents).

Finally, the respondents made the following suggestions when asked what needed to be done:

- To begin the system in the blended format (both faces to face and online),
- To make appropriate payment (incentive) for the course developing staff,
- To share the experiences of institutions that already adopt eLearning.

To conclude, it was found from this study that all the above responses were relevant and could validate the steps suggested for eLearning adoption.

7.4.2 Quantitative data analysis on validating a methodology for eLearning adoption

This section presents the descriptive analysis of the attitude of experts and instructors on the methodological steps of eLearning adoption. Data was collected for this section of the study by administering a questionnaire to instructors and ICT directors. There were insignificant missing values and data outliers in the data due to the fact that the respondents were very experienced with regards to the subject matter being studied. Questionnaires were submitted online to 155

participants for the purpose of gathering data required to validate the relevance of the steps in the methodology for eLearning adoption in Ethiopian higher learning institutions.

Table 7-16:Responses of eLearning experts and instructors on validating a methodology for eLearning adoption

Questions	No. of respondents				
	SG (%)	Agree (%)	Neutral (%)	Disagree (%)	SD (%)
Assessment of whether there is an eLearning system that is practiced currently in the institution	50	35	10	10	10
Assessment of whether there is beginning regarding eLearning implementation or not.	45	45	15	5	5
Assessment of eLearning readiness (psychological, finance, technological and content) in the adopting institution	50	40	0	15	5
Identification of eLearning components that are used currently if any	50	40	10	5	5
Identification of weaknesses of the current eLearning practice if any	35	35	30	10	5
Identification of eLearning model/framework that can fill the gap of the current practice	50	30	25	5	5
Identification of new eLearning components that are relevant from the selected model and integrate with the old one	55	35	15	10	0

Table 7-16 shows that more than 80% of the respondents agreed that almost all the steps in the methodology for eLearning adoption were relevant. Both quantitative and qualitative data analysis results revealed that the methodology for eLearning adoption as suggested in this study was

appropriate and acceptable. However, a number of respondents suggested that iteration of the process from step 5 to 1 should be shown, since it was believed that after integrating and implementing the improved version of eLearning, the next step would be to assess the current practice, followed by conducting the maturity assessment; after which the process could be repeated. The improved methodology with the iterative feature is illustrated in Figure 7.19 below.

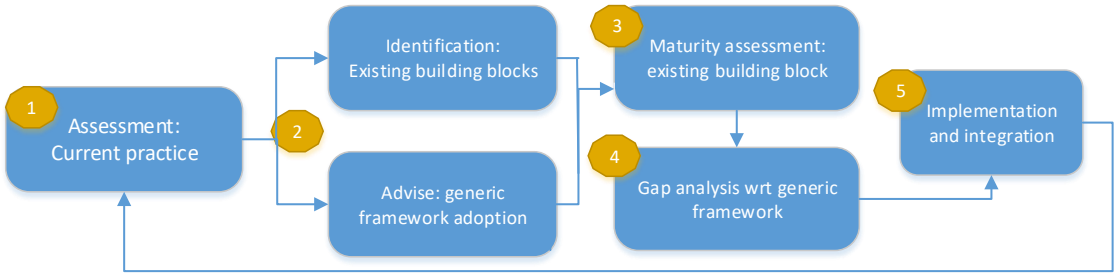


Figure 7-19: The improved methodology for eLearning adoption.

7.5 Chapter Conclusion

The aim of this chapter is to analyse the collected data to evaluate and validate the generic eLearning framework and methodology for eLearning adoption. The objective is to obtain feedback and to elicit suggestions for an improved version of the framework. The main deliverable of this chapter is a validated and improved generic eLearning framework, and a methodology for eLearning adoption. As such, it addressed the research objective which is to "Evaluate and validate the generic eLearning framework, and a methodology for eLearning adoption and a taxonomy in a real-life context."

To sum up, no new building blocks are suggested by the experts and stakeholders. The seven original building blocks are found to be adequate, however, the names of three building blocks are changed as a result of feedback. Changes are also made to the framework to improve linkage and flow between the seven building blocks and the metrics knowledge base.

After renaming, the seven building blocks of the generic eLearning framework are now known as: Institutional readiness; Pedagogy; Technology; Information management; Culture; Ethics and Monitoring and Evaluation. The methodology for eLearning adoption has been improved by making changes to the information flow. Iteration has now been included in the steps of the methodology.

The material presented in this chapter will form the base for Chapter 8, which covers the selection of the appropriate eLearning framework from the taxonomy tree as proposed in Chapter 5.

8 CHAPTER EIGHT: CASE STUDY – FRAMEWORK SELECTION FROM THE TAXONOMY TREE

8.1 Introduction

This chapter is the continuation of the work covered in Chapter 7 with emphasis on the evaluation and validation of the taxonomy tree presented in chapter 5. The outcome of this chapter will contribute to fully achieving sub-objective 5 of this thesis on evaluation and validation. The focus begins that of answering the now narrowly framed sub-research question 5:

"***How is our proposed taxonomy evaluated and validated in a real-life context of Ethiopian learning institutions"?***

As has been clearly articulated in the title of the chapter, the answer to this research question is provided through a case study targeting a range of universities in Ethiopia. The process of answering the question posed above began with selecting those universities, then determining their current practice with regard to eLearning and then attempting to pin-point the appropriate framework pertaining to the university from the taxonomy tree. After that, the current maturity of the framework was assessed and suggestions made on action to be taken to improve on the maturity level.

The next parts of this chapter is organised as follows: Section 8.2 discusses the status of the current eLearning practice within selected universities, and it also demonstrates the application of the taxonomy tree to locate the position of the institution in the taxonomy tree for further maturity assessment. Finally, a conclusion of the chapter will be presented in section 8.3.

8.2 Current eLearning practice in Jimma, Arba Minch, and Adama Universities

In this section, the formal representation of the generic eLearning framework discussed in chapter 4 was used to perform an assessment similar to that of Wollo University discussed in section 4.5 of Chapter 4. The purpose of the assessment is to evaluate the performance of the various building blocks that make up the generic eLearning framework for each participating university. The outcome of this assessment will enable this researcher to identify the corresponding node in the taxonomy tree for each participating university.

8.2.1 Participating Universities

For the purpose of this case study, three universities namely: Jimma University (JU), Arba Minch University (AMU) and Adama Science and Technology University (ASTU) were selected. The selection criteria was based on the reality that these universities are regarded as the pioneers of eLearning practice in Ethiopia. As such, they are considered to have reasonably well implemented eLearning frameworks in the country. The current eLearning practices of these universities were assessed and the data collected were analysed. The results of the data analysis and findings are presented in the subsections below.

8.2.2 Data preparation, analysis and key findings

Before proceeding to analyse data quantitatively, the quality of the data collected has to be checked in order to identify and address any missing data, outliers and doubtful patterns, as described below:

- **Data outlier**

  No outliers were observed from the collected data. A plausible explanation to this may be that because the respondents had been using the eLearning system for more than three years, they were familiar with the system and the topic, and therefore were unlikely to give any unusual responses to the questionnaire.

- **Missing values**

  Missing values can affect the results of data analysis especially if they are numerous. The acceptable threshold value as proposed in the literature is less than 15% per indicator in the questionnaire data. Questionnaires with more than the threshold value must be removed from the data analysis procedure. In this study, a number of student responses did not answer one question because it had been repeated in the questionnaire. The question coded as G6 was repeated twice in the questionnaire, and as a result one of the questions was removed. Also, a small number of students did not give answers for the questions coded: G5, G6, G7, In1, and tec1. However, because the number of missing values did not exceed the threshold value, the questions were not rejected from the questionnaire. As a result of a careful data collection procedure and the small sample sizes used in this study, only few missing values were observed in the Likert-scale type questions; but there were some in essay type questions. However, because this researcher uses the essay-type questions for triangulation purposes, no questionnaires were removed from the data before analysis.

- **Data collection tool**

  In this case study, data was gathered through analysing documents, observation, interviews and conducting a survey through administering questionnaires. The survey questionnaire was created using the notion of building blocks and their components, which is currently available in the literature. The questionnaire was made up of two parts: one part was used to elicit the demographic data and the second part was used to understand the current eLearning practice in ASTU, AMU and JU universities. The questionnaire for the survey consisted of a five-point Likert-scale type questions to assess the current status of eLearning practice in their universities. It also incorporated a few essay-type questions for the sake of cross checking (triangulation).

- **Sample size and its distribution**

  In this assessment 450 students and 170 instructors, were invited to participate in responding to the questionnaire, but only 211 students and 85 instructors actually responded to the questionnaire. For the purpose of conducting the interview, the original plan was to forward interview questions to selected students and instructors, but because of the political instability in Ethiopia at the time, this approach was not possible. As a result, only 20 experts and instructors were selected for interviews from three of the universities. As indicated in chapter 6, a purposive sampling technique was used, to select respondents, and as a result, only those people who were experienced in eLearning were selected. Table 8.1 presents the respondents sample size and its distribution.

Table 8-1: Respondents' sample size and its distribution for the assessment of the current eLearning practice

Name of universities that better implement eLearning at the current time	Student sample	Instructor and admin sample	Qualitative data through interview				
			ICT directors	Experts	Instructors	Document analysis	Observation
Arba Minch University (AMU)	120	38	1	3	4	✔	✔
Jimma University (JU)	91	40	1	3	4	✔	✔
Adama science and technology university (ASTU)	--	7	1	3	--	✔	✔
Total	211	85	3	9	8	✔	✔

- **Data analysis method for selection of a framework from taxonomy tree**

  For this case study, questionnaires, interviews, observation and document analysis were used as data collection tools. The data from the questionnaires were analysed using descriptive analysis methods with the help of SPSS V-25 statistical analysis software, because it is popular and best to do this kind of analysis. Qualitative data from the interviews were analysed using Atlas.ti version 9 software.

- **Respondents' demography over instructors' data**
  - **Gender distribution**

    All 84 respondents are male. This researcher was not able to get female respondents at the time of data collection. In the context of this study, gender variation does not bring discrepancy on the result of the analysis.

Table 8-2: Distribution of educational status

What is your educational status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	BSc	1	1.2	1.2	1.2
	MSc	75	89.3	89.3	90.5
	PhD	8	9.5	9.5	100.0
	Total	84	100.0	100.0	

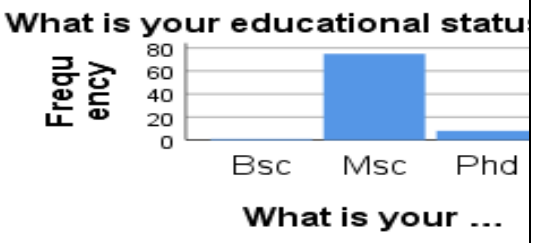


Table 8-3: Distribution of college/school to which that the respondents belong

Which college/school do you belong to?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	engineering	4	4.8	4.8	4.8
	Health	26	31.0	31.0	35.7
	other	1	1.2	1.2	36.9
	Social science	21	25.0	25.0	61.9
	Technology	32	38.1	38.1	100.0
	Total	84	100.0	100.0	

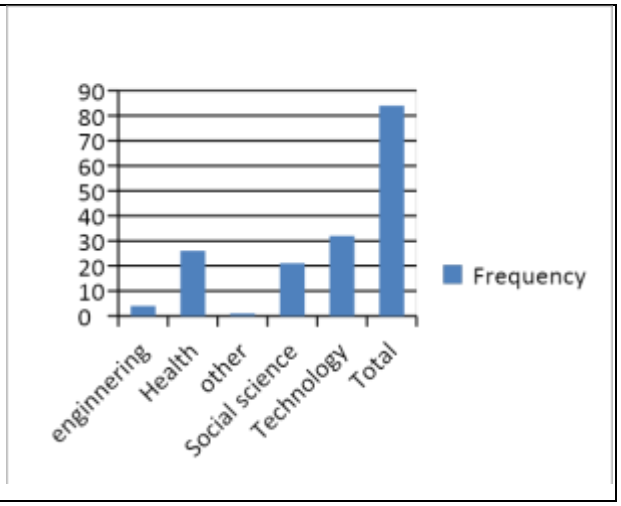
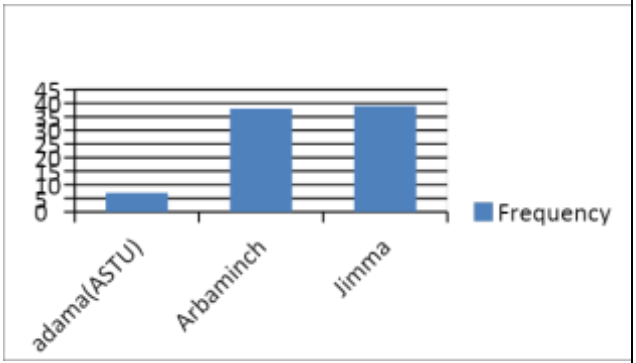


Table 8-4: Distribution of universities to which the respondents belong

The name of the university that you currently belong to_____.

	Frequency	Percent	Valid Percent	Cumulative Percent
adama (ASTU)	7	8.3	8.3	8.3
Arba Minch	38	45.2	45.2	53.6
Jimma	39	46.4	46.4	100.0
Total	84	100.0	100.0	



- **Respondents' demographic over students' data**

Table 8-5: Students' Gender distribution

G

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	22	10.5	10.5	10.5
	male	188	89.5	89.5	100.0
	Total	210	100.0	100.0	

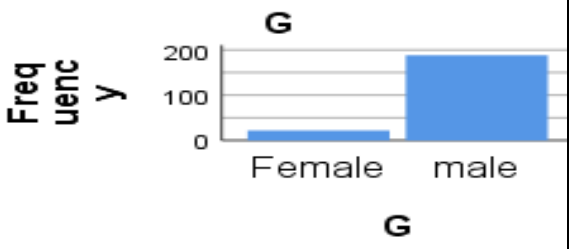


Table 8-6: Distribution of educational status

edS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Degree	132	62.9	62.9	62.9
	MSc	78	37.1	37.1	100.0
	Total	210	100.0	100.0	

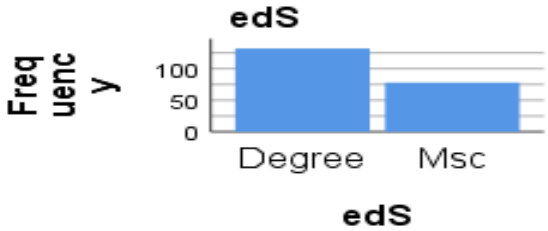


Table 8-7: Distribution of students' Year of study

SY

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	year 1	4	1.9	1.9	1.9
	year 2	114	54.3	54.3	56.2
	year 3	16	7.6	7.6	63.8
	>=year 4	76	36.2	36.2	100.0
	Total	210	100.0	100.0	

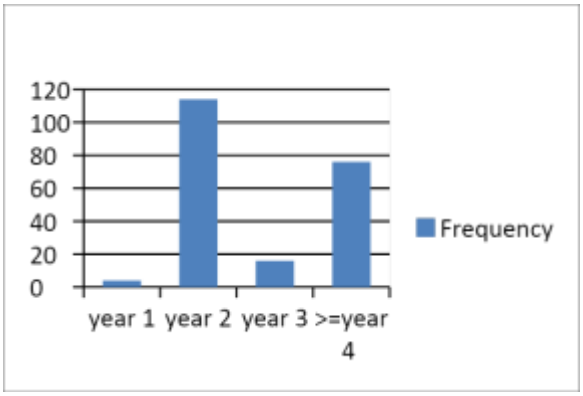


Table 8-8:Distribution of the college to which student respondents belong

college

	Frequency	Percent	Valid Percent	Cumulative Percent
Health	195	92.9	92.9	92.9
Natural science	15	7.1	7.1	100.0
Total	210	100.0	100.0	

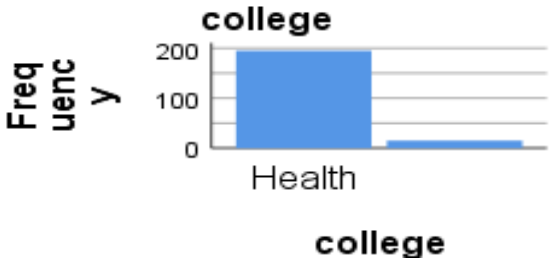
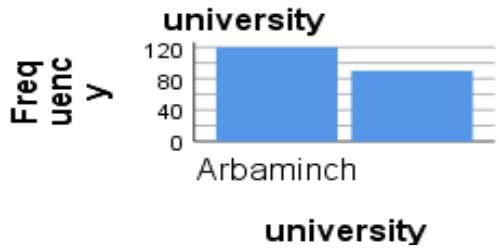


Table 8-9: Distribution of the university that the student respondents belong to

university

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	ArbaMinch	120	57.1	57.1	57.1
	Jimma	90	42.9	42.9	100.0
	Total	210	100	100	



8.2.3 Quantitative data analysis and key findings on the status of eLearning

- **Quantitative data analysis results on instructor's data**

Descriptive statistics of instructors' data in Arba Minch, Jimma and ASTU

Table 8-10: Descriptive statistics of instructors' data in Jimma University

		Mean	Std. Deviation
I1	39	1.82	.683
I2	39	1.85	.489
I4	39	1.85	.489
I5	39	1.82	.451
I6	39	1.85	.432
revI7	39	1.82	.389
revI8	39	1.85	.366
revI9	39	1.85	.432
revI3	39	1.82	.506
P2	39	1.95	.560
P5	39	1.90	.384
revp1	39	1.95	.320
revp3	39	1.90	.384
revp4	39	1.90	.502
T1	39	4.13	.409
T2	39	4.15	.489
T3	39	4.15	.366
T4	39	4.18	.389
T5	39	1.97	.280
T6	39	4.13	.409
T7	39	4.13	.409
M1	39	4.44	.502
M2	39	4.41	.498
C2	39	2.03	.362
C3	39	1.92	.480

revC1	39	1.90	.307
revC4	39	1.97	.280
revC5	39	1.97	.537
e1	40	1.92	.266
e2	40	1.95	.221
e3	40	1.95	.221
e4	40	1.92	.266
et1	40	1.95	.221
et2	40	1.92	.266
et5	40	1.92	.266
et6	40	1.97	.276
revet3	40	1.90	.303
revet4	40	1.90	.303
Valid N (listwise)	39		

The above descriptive table indicates that institution building block of eLearning at JU partially exists. As it is deduced from the above table, among the elements of the institution building block, giving the necessary training, for example, training on how to use eLearning is fairly well done in Jimma University as the majority of the respondents responded. Giving technical assistant to create email accounts and downloading notes and so on, are also the other facilities that the institution provides through the system. However, as shown in the above table, the mean value for the majority of the responses regarding the institution building block are located between the values: 'disagree (2) and strongly disagree (1)'. In line with this, it can be concluded from the table that the institution does not have the following:

- eLearning strategies to facilitate implementation of eLearning;
- does not give incentives to motivate users of eLearning; and
- there is no special financial fund for researchers to do eLearning related research, or to participate in eLearning conferences.

Regarding the pedagogy eLearning building block at JU, it has only been partially implemented as can be concluded from the result of the study. There is a balanced presentation of topics, and suitable levels of depth in the courses provided by the eLearning system. There is also continuity of the courses offered through the eLearning application. However, the pedagogical philosophy behind their eLearning application still forces instructors to be the main actors, like the teacher-centred traditional mode, rather than being a facilitator (student-centred approach). Also, as this researcher from the interviews, it is understood that there are no courses developed specifically for eLearning purposes; instructors were simply using their previous lecture notes and uploading them

to the eLearning system without incorporating relevant features for the course to be made understandable for students studying alone without the assistance of instructors.

Furthermore, the respondents pointed out that technology eLearning building block is almost in a mature state. Most of the requirements of technology building block have been fulfilled. The respondents' answers to the questions related to technology were 'agree and strongly agree'. The hardware and software requirements of the eLearning process have been almost fulfilled. The applications on the eLearning platform contain different aesthetic (attractive/friendly) features that help students perform their tasks easily (without much support). The application also takes less time to complete a task and users encounter errors less frequently. Furthermore, there is guidance on how to send mail and attach files in the eLearning application.

Regarding the Management component of eLearning building block, information dissemination is being executed well at Jimma University. Teaching materials can be easily uploaded to the right users in a secure way. There is also evidence that appropriate instructors are assigned to prepare courses.

The Culture component of eLearning is not well integrated in the eLearning system at Jimma University. As it is shown, in the above descriptive table, the mean value for the culture component is between 1 and 2 as it falls between 'disagree' and 'strongly disagree'. It does not cater for students from different cultures according to their need; for example, it does not indicate if they are achievement conscious or relaxed. In addition, students' or eLearning users' economic, social, political, language and religious diversity are not considered in the preparing or delivering an eLearning course. However, consideration is given to not using jargon terms, idioms, ambiguous or cute humour, and acronyms that have different meanings in different cultures. There is also an absence of navigational icons or images whose meaning is different in different cultures.

As it is shown in Table 8-10, the mean of responses with regard to evaluation of teaching-learning environment of the Evaluation building block at JU is between 1 and 2 that is between 'disagree' and 'strongly disagree'. Evaluation in line with the cost-effectiveness of the eLearning program, the satisfaction of teachers/students towards the eLearning application, the effectiveness of the e-content development process and also the measurement of individuals' skills, which are involved in e-content development are not supported by the eLearning system at JU.

As shown in Table 8-10, the Ethics building block is not given attention in the eLearning system at Jimma University. Firstly, geographical diversity among learners is not addressed by the eLearning application. Secondly, synchronous communications are also not scheduled and given attention by the eLearning system at JU. Thirdly, there is no also consideration of digital gaps among learners that can prohibit equity of access. Fourthly, there are no policies or guidelines to prevent plagiarism. On the positive side, some respondents said that the eLearning course is designed to support learners to adapt to an individualised distributed learning environment, and there are also diverse teaching styles to cater for diverse learners.

Table 8-11:Descriptive statistics of instructors' data in Arba Minch University

	N	Mean	Std. Deviation
I1	38	1.92	.673
I2	38	1.92	.428
I3	38	1.95	.462
I4	38	1.95	.324
I5	38	1.92	.359
I6	38	1.92	.487
revI7	38	1.92	.273
revI8	38	1.92	.273
revI9	38	1.92	.428
P1	38	1.92	.273
P2	38	1.92	.487
revp3	38	1.97	.434
P4	38	1.92	.428
P5	38	1.95	.226
T1	38	4.16	.547
T2	38	4.11	.311
T3	38	4.08	.273
T4	38	4.16	.370
T5	38	4.08	.487
T6	38	4.08	.487
T7	38	4.13	.343
M1	38	2.13	.343
revm2	38	2.05	.324
C2	38	2.00	.569
C3	38	1.97	.283
C4	38	2.03	.434
revc1	38	1.97	.283
revc5	38	1.97	.434
e1	38	1.97	.162
e2	38	1.92	.359
e3	38	1.97	.162
e4	38	1.97	.162
et1	38	1.97	.162

et2	38	1.97	.283
et4	38	1.95	.226
et5	38	2.00	.232
et6	38	1.97	.367
revet3	38	1.89	.311
Valid N (listwise)	38		

The above descriptive statistics in Table (8-11) show how well eLearning building blocks are incorporated in the implementation of eLearning at AMU. As the mean values in Table 8-11 indicate (between 'disagree' and ''strongly disagree), many of the components of the institution building blocks are practised well at AMU. Firstly, according to the respondents, necessary training, incentives, funds and other financial support are not arranged for the purpose of eLearning implementation. The institution does not give incentives to motivate eLearning users, and also do not give special funds for eLearning-related research and conferences. Secondly, eLearning policies and copyright components are not also given attention in the eLearning application. The institution does not have an eLearning strategy or plan to facilitate implementation of eLearning. Thirdly, there is also no policy to handle copyright issues regarding eLearning materials. On the positive side, some of the features of the institution building blocks such as academic computing services, which provide email accounts, managing servers and the like are available. Orientation services are also provided through the eLearning application at AMU.

In terms of Pedagogical issues, however, such as the balanced presentation of ideas, and appropriate level of detail in the courses, continuity of the courses offered in the eLearning application, clear alignment among learning goals, activities, assessments, and learner characteristics are not considered in eLearning system at AMU. Therefore, a student centred approach is also not facilitated by the eLearning application.

However, in terms of the technology building block, as in the case of JU, all technology infrastructure components have been fulfilled, and the software and hardware components have been addressed. In addition, the interface of the eLearning system is attractive and is user friendly. The application takes less time to complete a task and users commit errors less frequently while using the system. However, there is no technical support to assist eLearning users to create emails and access the system. Therefore, it is only through the effort of teachers and students themselves that this task is accomplished.

The Management building block, according to the respondents, has several negative aspects. Firstly, information dissemination through the eLearning system is not done effectively; and appropriate course content is not disseminated to the right users in a secured way through the system. However, the respondents agreed that the right instructor is assigned to prepare the right course.

The Culture component of eLearning is not considered well integrated in the eLearning system at AMU. It does not treat students from different cultures according to their needs regarding of whether they are achievement conscious or relaxed. In addition, students' or eLearning users' economic, social, political, language and religious diversity are not considered while preparing or delivering the eLearning course. Navigational icons, or images whose meaning may be different in different cultures are also not used in the AMU eLearning system.

The Evaluation component of the teaching-learning environment at AMU is not given attention. The cost-effectiveness of the eLearning program, satisfaction of teachers/students towards the eLearning application, effectiveness of the e-content development process, or the measurement of the skills of the individuals involved in the e-content development, are not supported by the eLearning system.

The Ethics building block is not satisfactory in the eLearning system at AMU. Geographical diversity among learners is not treated by the eLearning application. Synchronous communications are also not considered. The digital gaps among learners, are also not taken into account. Furthermore, there are no policies or guidelines to prevent plagiarism. However, some respondents said that the eLearning course is designed to support learners who adapt to an individualised distributed learning environment.

Table 8-12 below describes the status of eLearning at ASTU. Unfortunately, the number of respondents were not sufficient to generalise the case. This researcher could not get more than this number of voluntary respondents because the system had stopped working for some unknown reason, as indicated by some of the respondents.

Table 8-12: Descriptive statistics of instructors' data at ASTU

	N	Mean	Std. Deviation
I1	7	1.71	.756
I2	7	1.71	.488
I3	7	1.71	.488
I4	7	1.71	.488
I5	7	1.86	.378
I6	7	1.71	.488
revI7	7	1.71	.488
revI8	7	1.71	.488
revI9	7	1.86	.690
P1	7	1.71	.488
P3	7	1.71	.488
P4	7	1.86	.378
P5	7	1.86	.378
T1	7	4.14	.690
T2	7	4.00	.577
T3	7	4.14	.378
T4	7	4.14	.378
T5	7	4.14	.378
T6	7	4.14	.378
T7	7	4.14	.378
revm1	7	1.71	.488
M2	7	1.71	.488
C1	7	1.86	.378
C2	7	1.71	.488
C3	7	1.86	.378
C4	7	1.86	.378
C5	7	1.71	.756
e1	7	1.71	.488
e2	7	1.86	.690
e3	7	1.71	.488
e4	7	1.86	.690
et1	7	1.86	.378
et2	7	1.71	.488
et3	7	1.71	.488
et4	7	1.86	.378
et5	7	1.71	.488
et6	7	1.86	.690
revp2	7	3.71	.488
Valid N (listwise)	7		

According to the data presented in Table 8-12, the Institution building block is partially practised in ASTU as indicated by the mean value for the building block. There appears to be management of the eLearning application software and server. Students are also provided with an email account

to access the system. Orientation was arranged by the institution through the eLearning system. However, although there was an attempt to give the necessary training for eLearning users it was not successful. The institution did not have eLearning strategy or a plan to facilitate implementation of eLearning. There was also no policy to handle copyright issues regarding eLearning materials. The institution did not give incentives to motivate eLearning users, also it did not give special funds for eLearning related research and conferences.

As with AMU, Pedagogical issues such as balanced presentation of ideas, and appropriate level of detail in the courses, continuity of the courses offered in the eLearning application, clear alignment among learning goals, activities, assessments, and learner characteristics were not considered in the eLearning system of ASTU. The respondents, however, said that the eLearning system was good in terms of the role of teacher as facilitator.

Regarding the Technology building block, as in the cases of JU and AMU, all infrastructures are fulfilled; the software and hardware components are fulfilled by the support of KOICA (Korean teams). The interface of the eLearning system is attractive and user-friendly. The application takes less time to complete a task and users commit errors less frequently while using the system. There was also technical support to assist eLearning users to create emails and to access the system.

Regarding the Management building block, information dissemination through the eLearning system was managed effectively; appropriate course content was disseminated to the right users in a secured way through the system. However, the respondents agreed that the right instructors were often not assigned to prepare the right course.

The Culture component of eLearning was not well integrated in the ASTU eLearning system. It did not treat students from different cultures according to their needs; whether they are achievement conscious or relaxed. In addition, the students' or eLearning users' economic, social, political, language and religious diversity were not considered while preparing or delivering the eLearning course. Additionally, the use of navigational icons or images whose meaning is different in different culture have not been considered.

With regard to the Evaluation component, as the mean value in Table 8-12 indicates, the cost-effectiveness of the eLearning program, the satisfaction of teachers/students towards the eLearning application, the effectiveness of the e-content development process, and the measurement of individuals' skills, who are involved in the e-content development, are not supported by the eLearning system at ASTU.

The Ethics building block has also not been given attention in the ASTU eLearning system. Geographical diversity among learners is not treated by the eLearning application. Synchronous communications are not scheduled, and the existence of digital gaps among learners has not been considered. There are also no policies or guidelines to prevent plagiarism. The eLearning course is not designed to support learners who adapt to an individualized distributed learning environment.

- **Testing the measurement model over instructors' data**
  - **Reliability and validity test results using instructors' data**

    Table 8-13 shows the reliability and validity test results of the measurement tool. The numbers in the table are good indicators of construct reliability and validity since the threshold value for Cronbach's alpha, composite reliability and average variance extracted are: 0.7, 0.7 and 0.5 respectively.

Table 8-13: Constructs' reliability and validity of instructors' data

Building blocks	Cronbach's alpha measure	Composite reliability	Average variance extracted
Institution	0.851	0.915	0.547
Pedagogy	0.628	0.845	0.526
Technology	0.716	0.778	0.381
Management	0.842	0.904	0.824
Culture	0.731	0.863	0.565
Ethics	0.711	0.854	0.499
Evaluation	0.782	0.858	0.609

- **Quantitative data analysis result on student's data**

Table 8-14: Descriptive statistics of students' data in Arba Minch University

	N	Mean	Std. Deviation
gen1	120	3.44	.837
gen2	120	3.24	1.084
gen3	120	2.74	1.126
gen4	120	3.29	.901
gen5	116	3.03	1.408
gen6	116	3.10	1.468
gen7	116	2.93	1.036
gen8	120	2.87	.875
gen9	120	3.33	1.189
gen10	120	2.67	.962
In1	117	1.90	.547
In2	120	1.92	.294
In3	120	1.91	.366
Pd1	120	1.89	.312
Pd2	120	1.87	.332
Tec1	115	4.23	.426
Tec2	120	4.20	.422
Tec3	120	4.22	.413
Tec4	120	4.20	.478
Tec5	120	4.15	.529
Tec6	120	2.02	.580
Tec7	120	4.19	.454
Mg1	120	4.29	.452
Mg2	120	4.29	.456
Mg3	120	4.29	.491
Mg4	120	4.31	.463
CU1	120	2.00	.343
Cu2	120	1.95	.219
CU3	120	1.95	.407
CU4	120	1.98	.343
CU5	120	1.98	.259
CU6	120	1.99	.275
CU7	120	1.99	.304
ev1	120	2.25	.713
ev2	120	2.27	.785
et1	120	1.94	.298
et2	120	1.94	.298
et3	117	1.94	.238
et4	120	1.97	.274
et5	120	1.96	.239
et6	120	1.97	.257
et7	120	1.94	.235
revt6	120	3.98	.580
Valid N (listwise)	101		

The descriptive table (Table 8-14) shows that additional generic questions were asked of the AMU student respondents so as to understand to what extent technology was used to facilitate implementation of eLearning at AMU. From the results of the study, it can be deduced that the use of electronic learning (eLearning) software to facilitate education was applied 'sometimes', or 'rarely', and 'not frequently'. Chat and discussion forums through the eLearning system were done rarely. Teachers were using the eLearning system to upload course materials rarely. Education related news reaches the student through the eLearning application (software) very rarely.

Apart from the generic questions, specific questions related to the building blocks of the generic eLearning framework were asked. Regarding the institution building block, the respondents indicated that the support of institution in usage of the system was weak; no support in accessing the system through secured means, no support in downloading and uploading and also no support in the use of teleconferencing. There was also no orientation by the institution about the eLearning system.

Regarding the Pedagogy building block, AMU students pointed out that there was no balanced presentation of ideas and proper level of detail in the courses and also, they said that they had not seen any sense of continuity on the eLearning courses.

As far as Technology building block was concerned, the students indicated that the application (the eLearning system) contained different artistic (attractive) features and that helped students perform their tasks more easily. There was also clarity of instruction in the eLearning system and descriptions of what the students should do at each step of learning. In addition, the application (eLearning system) took less time to complete a task, and errors were rare. Students further pointed out that there was guidance on how to send emails and attach files in their eLearning application, but there was no guidance on how to set up hardware for video conferencing.

Regarding the Management building block, students reported that there was clarity with announcements, schedules and course relevant contacts in their eLearning application. Students' assignments, quizzes as well as grades could also be submitted and accessed through the eLearning application. There is also the means for the students to log into and out of the system easily. In terms of the Culture building block, students stated it is ignored in the eLearning system at AMU as students were not treated differently based on their culture, social, political and economic diversity. Therefore, language and religious diversities were not considered in either the course

development or delivery. Owing to this, effective communications among students and teachers were not successful.

For the Evaluation building block, students pointed out that performance of learners after taking the e-course was not measured online. The same was also true for learner satisfaction. It was not measured online. Respondents also pointed out, the Ethics building block was not integrated into the AMU eLearning system. Geographic diversity and digital gaps of learner were also not considered and so there was no equal accessibility of information for different learners. Furthermore, they pointed out that there were no rules for governing mutual respect among learners in discussion groups, nor were there any rules on how to behave and post messages in online discussions to prevent hurt to others feelings.

Table 8-15: Descriptive statistics of students' data in Jimma University

	N	Mean	Std. Deviation
gen1	91	4.00	.816
gen2	91	3.01	1.005
gen3	91	3.84	.893
gen4	91	3.84	1.210
gen5	91	2.02	.869
gen6	91	2.83	1.067
gen7	91	2.68	1.255
gen8	91	3.50	.957
gen9	91	3.17	1.344
gen10	91	3.82	.692
In1	91	4.11	1.120
In2	91	4.17	.946
In3	91	4.13	.909
Pd1	91	1.78	.489
Pd2	91	1.80	.452
Tec1	91	4.40	.611
Tec2	91	4.46	.520
Tec3	91	4.44	.519
Tec4	91	4.41	.492
Tec5	91	4.40	.512
Tec6	91	2.31	.486
Tec7	91	4.43	.597
Mg1	91	4.42	.494
Mg2	91	4.43	.496
Mg3	91	4.41	.514
Mg4	91	4.43	.496
CU1	91	1.92	.521
Cu2	91	1.97	.458
CU3	91	1.94	.431
CU4	91	1.98	.471
CU5	91	1.97	.458
CU6	91	1.99	.483
CU7	91	1.92	.453
ev1	91	4.27	.490
ev2	91	1.79	.527
et1	91	1.96	.514
et2	91	1.98	.364
et3	91	1.97	.314
et4	91	2.02	.421
et5	91	1.99	.408
et6	91	1.99	.408
et7	91	1.99	.408
revev1	90	1.7333	.49264
Valid N (listwise)	90		

According to the descriptive statistics presented in Table 8-15, Jimma University students were also asked the generic questions and their responses were similar to those of AMU students. Answers to these generic questions enabled this researcher to understand the extent to which the eLearning system was practiced at JU, and how frequently the system was applied in the teaching and learning process. The answers to these generic questions indicated that technology was not used frequently in the teaching-learning process, rather it was used infrequently or only sometimes.

For the Institution building block, the respondents at JU indicated that institutional support of the system was good. There is some support for accessing the system and providing email accounts for eLearning users. There is also support for downloading and uploading of files, and for teleconferencing. Support for system orientation is also facilitated in the JU eLearning system.

For the Pedagogy building block, JU students pointed out that there was no balanced presentation of ideas and appropriate levels of detail in the courses, and also there was no sense of continuity on eLearning courses. As far as the Technology building block is concerned, students indicated that the application (the eLearning system) contained different artistic (attractive) features that helped students perform their tasks more easily. Also, there was clarity of instruction in the eLearning system and descriptions of what the student should do in each step of learning. The eLearning system also took less time to complete as task with minimal errors. Students also pointed out that guidance was provided on how to send emails and attach files, but that there was no direction on how to set up hardware for videoconferencing.

The Management building block was reported by JU students as having clarity in terms of announcements, schedules and relevant course contact in the eLearning application. Students could submit assignments and answers to quizzes, and could access their grades through the system. Students could also log in and out of the system easily.

On the other hand, students reported that the Culture building block has been ignored. Students are not treated differently based on their cultural, social, political and economic diversity. In addition, language and religious diversities are not considered when courses are developed and delivered. As a result, effective communication between students and teachers is not successful.

Regarding the Evaluation building block, students pointed out that while learner performance can be measured through the eLearning application, learner satisfaction cannot be measured.

The Ethics building block has not been integrated into the eLearning system, and as a result geographic diversity and learner digital gaps have not been considered. This has an impact on equal accessibility of information for learners. Furthermore, there are no rules for mutual respect among learners in discussion groups or for how to act when posting messages in online discussions in order not to hurt other people's feelings.

- **Testing the measurement model over students' data**

Table 8-16: Reliability and validity test results on students' data

Building blocks	Cronbach's alpha measure	Composite reliability	Average variance extracted
Institution	0.970	0.929	0.814
Pedagogy	0.561	0.768	0.624
Technology	0.728	0.898	0.577
Management	0.698	0.798	0.498
Culture	0.841	0.881	0.516
Ethics	0.756	0.817	0.392
Evaluation	0.749	0.769	0.625

8.2.4 Qualitative data analysis on the status of eLearning

In this section, the interview data taken from instructors and ICT experts from JU, AMU and ASTU were analysed using Atlas.ti 9 and Microsoft Excel 10. The results of this analysis from the interview data are used to triangulate with the results of the analysis from the quantitative data as described in the previous section.

- **Jimma University**: Only eight voluntary interviewees, comprising instructors and eLearning experts were selected intentionally using the purposive sampling technique. For the question: "Does the institution give, or arrange necessary training for eLearning users; both students and instructors?" Six of the respondents answered that they have taken some skills gap training, but it was not enough to be able to use the eLearning system effectively. Two of the

respondents said that they had not taken the training, and they were not even sure whether training was being offered or not. The respondents were also asked the question: "Does the institution give funds for eLearning-related researches and conferences?" Five of the respondents said that there was no special fund for eLearning purpose. The other three said that they are not sure about the issue of funding. The question: "Is there an incentive offered by the institution to facilitate the use of eLearning?" was also asked, and all of the respondents said that there was no incentive arranged for eLearning users. The respondents were asked: "Is there an online counselling facility that could be integrated into the LMS at JU?" and five out of the eight respondents answered that there were no counselling services integrated with the LMS. Only three said that they are not sure whether there was an integrated counselling service or not. The same was also asked about the integration of registration and application services with the LMS. Seven of the respondents replied that there were no integrated registration and application systems with the LMS at JU. Only one of the respondents said that he was not sure whether these services were integrated with the LMS. Respondents were also asked whether there was a library and book store service integrated with the LMS, and almost all of the respondents said that there were no integrated library and book store services, but there was a separate library system. Regarding eLearning policy and copyright issues, all of the respondents at JU said that there was no eLearning policy or copyright issue at JU.

All the above responses indicate that the institutional readiness of JU is weak. The university needs to work on the institutional readiness building block based on the parameters as outlined in the generic eLearning framework.

Experts were also asked to respond to the question "Is there an organised e-course development process that can generate e-courses appropriate for the eLearning environment?" Almost all of the responses are discussed below:

- "No. The course materials developed by individual instructors for traditional mode of delivery are simply uploaded for eLearning purposes."
- "No. We don't give emphasis to develop course materials that are appropriate for eLearning purposes."
- "No. The course materials development is very important but not started in our institution."
- "No, there are no course materials developed for eLearning purposes."

Given the foregoing, it is plausible to conclude that pedagogy-based e-course content production has yet to be done. The respondents also mentioned that the university was preoccupied with other technical concerns rather than course development.

Furthermore, respondents were asked questions related to technology; the hardware and software as well as the interface. Almost all respondents at JU raised the following points:

- "*Almost majority of the technological requirements are fulfilled. Student-computer ratio is almost proportional at the MSc level, but somehow unbalanced at the undergraduate level, although this problem has been curbed because students now have laptops.*"
- *"Almost majority of the requirements are fulfilled but still the Student: Computer ratio is disproportional."*
- *"Yes, it is usable; I haven't faced any problem of accessing the system."*
- *"Yes, more or less, it is customised to our context so it is usable."*
- *"Yes, the interface is user friendly."* (See Figure 8-1).

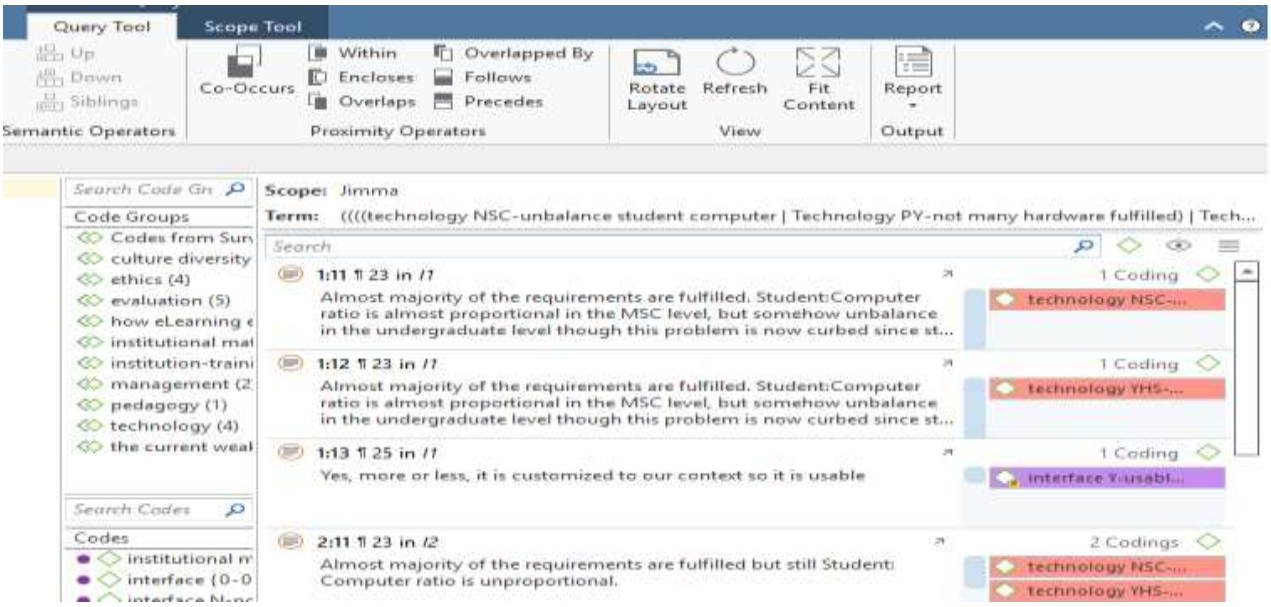


Figure 8-1: Some responses on the status of technology in JU (source Atlas. ti 9)

In terms of technical support, the respondents were asked whether there was a dedicated technical team (support) to assist eLearning users. All of the respondents said that it was the teacher who provided technical support. There were no technical support teams.

To sum up, three of the respondents pointed out that majority of the technological requirements have been fulfilled including, the student-computer ratio, even at the undergraduate level. Another three respondents said that the student-computer ratio was still unbalanced. The remaining two were not sure about the student-computer ratio. Regarding user interface, all of the respondents said that because the user interface had been customised to their context, it was easy to use and was user friendly. They also said that there were no separate technical teams that could support eLearning users.

The JU respondents were also asked the question: "Does the eLearning system support all quiz, exam and other evaluations?" Seven of the respondents said that there was a student evaluation service in the LMS but the majority of the instructors were not using it. With respect to this, one of the experts suggested that the reason why some instructors were not using the evaluation facility was because of the unbalanced student-computer ratio. With regard to the teaching-learning environment, all of the respondents said that there was no means to evaluate teaching learning environment at JU.

The respondents of JU were also asked the question: "Are the log in/log out, upload/download facilities well established in the eLearning system?" They said that students or instructors could log in and log out of the system. These activities were well controlled by the system and it did not to allow unauthorized users to use the system. The same was also true for uploading and downloading. They were also asked: "Does the eLearning system incorporate facilities that can provide clear announcements and schedules to eLearning users?" The students all agreed that schedules and announcements of course-related matters were being distributed through the eLearning system. The respondents were also asked whether the eLearning system at JU was designed by considering economic and political diversity of eLearning users. Seven of the respondents said that the eLearning system did not consider the economic and political diversity of learners. Only one was not sure whether the system considered the economic and political diversity of learners. Again, all of the respondents said that there was no consideration of religious and language diversity of users in the design of the eLearning system.

Experts were also asked about social diversity. They agreed that the system did not consider social diversity among learners. They supported their answers by saying that eLearning was in the early stage of development and the design of the LMS did not consider social diversity. It was also pointed out that there were no ethical rules that could guide discussions on the eLearning system.

In line with this, three respondents said that they had not seen any ethical rules that could guide discussions between students and instructors.

Respondents were also asked to propose ideas about whether there was equal access of education or not. Almost all replied along the following lines: "*I believe that the education is accessible to all but I don't know to what extent the system equally treats all users*."

Eight interviewees from AMU were also selected intentionally using the purposive sampling technique. When asked the question, "Does the institution give or arrange necessary training for eLearning users (both students and instructors)?" They provided the following answers:

- *Yes, but it is not given for all possible users. It is still in early stage*.
- *There are some skills gap training and motivational training (introduction to eLearning) courses, but they don't have continuity.*
- *Yes, but some. A training course was given once when the implementation of eLearning starts.*
- *I don't get any training, maybe I missed it.*

Based on the above, it is concluded that at AMU, there are some skills gap training courses to help implement eLearning but they are not enough. On the other hand, only one respondent said the he is not sure whether the training was being given or not. The respondents were also asked to provide their opinions regarding whether there was an integrated counselling service or not with the eLearning portal. Five respondents were not sure whether there was integrated counselling or not. On the other hand, three said there was no integrated counselling with the eLearning portal.

The respondents were also asked the question, "Does the institution give funds for eLearning related researches and conferences?" Six of the respondents said that there was no special fund for eLearning purposes, and two of the respondents that said that they were not sure whether there were funds for eLearning implementation or not. All the respondents at AMU said that there was no incentive provided to eLearning users for motivational purposes. There was also no policy to facilitate implementation of eLearning, as reported by all respondents. Regarding the integration of library and book store services, and the application and registration services, all the respondents said there were no integrated library, book store, application and registration services in the system because eLearning was still in its infancy, and the integration process had not yet been completed. They further elaborated that there was a separate library and registration system. Furthermore, the respondents also pointed out that the issue relating to copyright had not been considered in the

implementation of eLearning. As a result, instructors were not happy to upload their lectures or their course material to the system.

When respondents are asked about preparation of course-material for eLearning purpose, they provided the following answers:

- *The course material used for eLearning purpose is the old one. Even uploading the old course material to eLearning mode is a challenge because of copyright issues.*
- *We haven't developed new course materials that can fit the eLearning environment.*
- *The course materials developed by individual instructors for traditional mode of delivery are simply uploaded for eLearning purpose.*
- *Still now, there is no initiative to develop a course for eLearning purposes.*

Based on the above responses, it can be concluded that there was no attempt to develop course material for eLearning purposes. The old course material was still being used for eLearning purposes. In addition, the copyright issue was also raised by instructors.

Regarding technological requirements, 88% of the respondents said that almost majority of the requirements had been fulfilled, although there was a challenge relating to the student-computer ratio in some departments at undergraduate level. This problem did not appear to exist in IT related fields. On the other hand, 22% of the respondents said that many of the hardware and software requirements had not been fulfilled. In response to the question: "Is there a technical support facility for easy use of eLearning? Seven of the respondents said that there was no separate technical support. They further said the teacher provided some technical support for their students. However, one respondent said there were some technical staff that were supporting them to facilitate use of the portal. Regarding the interface of the eLearning portal at AMU, two of the respondents' said that some parts of the interface were difficult to understand, in contrast; six respondents' said that the interface of the portal was easy to use and they had no problem in understanding it.

Regarding Management of information, respondents said that all valid users (students or instructors) could log in and log out as well as upload and download. They also said that schedules and announcements of a course related nature were being distributed through the eLearning system. With regard to Evaluation, the system did support evaluation of students, but instructors were not using it. The majority of respondents said the reason for instructors not using the evaluation system was fear of security and the unbalanced student-computer ratio. Regarding

system evaluation, respondents said that there was no facility in the portal to evaluate the teaching-learning environment.

The respondents were also asked the question: "Is there equal access to education?" All respondents, except one, agreed that there was equal access to education. However, when asked to give reasons for their answers, they stated that while the system did not discriminate between students, it could be the student's digital skills that made them either and active, or passive user of eLearning. It has been deduced from the evidence that nothing was being done to make users' equal in their access to the system, either through training or other initiatives.

To the question: "Does the eLearning system consider economic and political diversity among the users of eLearning?" Two of the respondents were not sure whether the system considered the economic and political diversity of users; the rest of the respondents were very clear, and believed that the system did not consider the economic and political difference of users and treat them accordingly. Respondents were also asked whether language and religious diversity as well as social diversity was considered while designing and implementing eLearning. Seven of the respondents said that there was no consideration of language and religious diversity or social diversity. Some of the responses given are as follows:

- *The medium of instruction in the eLearning system is only English.*
- *No. The content and mode of delivery of the course is the same for all kind of learners, no special treatment is made for some or so.*
- *Since our eLearning is in the early stage, issues like social diversity aren't given attention.*
- *Religious and language diversity are not given attention by our eLearning portal.*
- *The medium of instruction in the eLearning system is only English and I haven't seen any room to treat religious diversity.*

Regarding Ethical rules for discussion on the eLearning portal, five respondents said that there was no ethical rule on discussion. The other three said that they were not sure whether there was an ethical rule for discussion or not. Some of the responses were as follows:

- *If the instructor is enthusiastic to use eLearning, he/she can easily control their discussion otherwise no ethical rule.*
- *No, there is no ethical rule to facilitate discussion but can easily be controlled by the teacher.*

At ASTU, only three voluntary respondents were selected using purposive sampling technique. Regarding counselling, they said that there was no counselling facility that could be integrated with. In line with this, regarding library and book store service, all of the respondents said that there was no integrated library and book store services in the eLearning portal, but there was a separate library and book store service. The same was also true for integrated registration and application services. Respondents also said that there was a plan to integrate the registration and application service with the eLearning portal but it had not been done as yet. Thus, there was a separate registration and application system. When the question: "Does the institution give funds for eLearning related researches and conferences?" was asked. The following opinions were raised:

- *No, I am not sure whether there is fund for eLearning researches or not but there is a research fund for all fields though that is very limited.*
- *No special fund for eLearning researches but there is a research fund for all fields though that is very limited.*

The respondents also answered the following for the question: "Does the institution provide incentives for e-course developers and also eLearning users in the institution?"

- *No, there was an attempt to give incentive, but it has stopped now because of unknown reasons.*
- *No, I haven't seen any incentive.*

For the question: "Is there eLearning policy or strategy in your institution?" the following opinions were raised:

- *Yes, there is policy, but still under development.*
- *Not at all. I haven't seen any eLearning policy.*

Regarding training services given by ASTU for eLearning users, respondents said that there was some skill gap training and motivational training (introduction to eLearning) though it is only given once for some departments but it will continue. Regarding copyright issues, respondents said that there was no concern for copyright issues.

When the question, "Is there an organised e-course development process that can generate e-course appropriate for the eLearning environment?" was asked, the following opinion was stated:

- *No. The course materials developed by individual instructors for traditional mode of delivery are simply uploaded for eLearning purpose.*

Regarding Technological requirement at ASTU for eLearning purpose, respondents said that amazing computer labs and smart classrooms had been established. Hardware and software requirements of eLearning systems had been fulfilled and that was no longer a problem at this university. In line with this, respondents added that the user interface had more or less been customised for their context and it was usable. Regarding availability of technical support service in the implementation of eLearning, 67% of the respondents said that there was no separate technical support; it was the teacher who provided the support.

Regarding the Evaluation facility of eLearning portal, almost all of the respondents said that majority of the instructors were not using the evaluation facility of the eLearning portal. In line with this, respondents also said that there was no facility for evaluation of the teaching-learning environment. Regarding management of information, respondents at ASTU said the following:

- *Students or instructors can log in and out to and from the system. These activities are well controlled by the system itself not to allow unauthorized users to use the system. The same is also true for uploading and downloading.*
- *Yes. Schedules and announcements of course related matters are being distributed through the eLearning system.*

With regard to the concern for economic and political diversity; it was reported that economic and political diversity among eLearning users was not given attention. The same is also true in the case of language and religious diversity. All of the respondents said that there was no consideration of religious and language diversity among learners as well as instructors. In line with this, the respondents said the following:

- *No, our eLearning is in the early stage so doesn't consider the social diversity.*

Concerning Ethical rules, respondents at ASTU said there were no ethical rules for discussion, but they felt that the teacher could easily control discussion. Another 66% of the respondents believed that the eLearning portal was ethical since it could provide equal access of education to all. All in all, it did not benefit only one group. However, 30% of the respondents could not say that there was equal access to education because the system did not consider economic, social, political and language diversities among eLearning users.

8.2.5 Current status of eLearning in the selected universities and the taxonomy tree

This part of the chapter summarizes the above findings of the case study on the current status of eLearning in some selected Ethiopian Universities and locates their position in the taxonomy tree.

- **Summary of the current eLearning practice**

Jimma and Arba Minch universities. In this two universities**,** the status of the institutional building blocks are almost the same. The institution is trying its best to give necessary training for users, to provide orientation through the eLearning system as well as to balance the student-computer ratio and internet connection. However, they do not give emphasis to incentives to motivate users and developers of eLearning or courses, no funds for research and conferences regarding eLearning as well as no initiatives to develop eLearning policies that also incorporate a copyright policy. Furthermore, students are not initiated in the use the system for application and registration as well as for payment purposes. These facilities are not integrated with the existing eLearning system. Above all the institutions do not emphasise integrating library services, book store services, or consultation services with their existing eLearning systems. There is low motivation to allocate enough budget for the implementation and use of the system. It seems that even the top and middle level managers of the universities are not aware of the advantages of eLearning. It is possible that they may be preoccupied by other issues. Consequently, users of the eLearning system; instructors as well as students, are not motivated enough or confident enough to use the system. According to the respondents of the interviews, even awareness and motivational training on how to use the system has stopped.

There are no systems or policies to make eLearning sustainable, nor are there policies to make instructors and students responsible for using the system, which is still on a voluntary basis. One of the respondents commented that if teachers were motivated and energised to use the system, they would motivate their students to use and exploit the system more effectively. Without teacher support and encouragement, the students will not use or understand the system well enough. The issue regarding copyright is also of concern for the majority of the instructors, but this has not yet been addressed by either institution.

Adama University is a little different from the above two universities. The eLearning system was established by the support of KOICA (Korean international cooperation Agency). In the first semester of 2019, the system was being implemented in the technology and engineering departments of ASTU, but, unfortunately it has since stopped due to unforeseen circumstances.

The beginning of the implementation was very ambitious and many things were done, including providing the training for the users of the system. There was also an attempt to develop e-courses although there were no incentives or funds to motivate users of the system. In addition, the copyright issues were not addressed. The application and registration, and library and book store services were also not integrated with the system. There was no counselling service available through the system.

For the **Pedagogy building block**, again **Jimma and Arba Minch universities** are at the same level. In both institutions, there has been no attempt to organise teams and develop courses so as to make courses more easily understandable for students who are physically separated from the instructor. eLearning courses should be different to face-to face courses because they should be understandable without the teacher, but it was not true in these universities. One of the respondents of the interview commented that at Arba Minch University, it was the instructors' and not the institution who made the effort to make their courses suitable for eLearning. The respondent further explained that if the instructor was motivated and energetic, they could come up with a good design for an eLearning course, if they were not motivated, the opposite would happen. This interviewee again recommended that if the e-course was designed by a team, the quality and clarity of the course could be increased. Currently, courses designed for traditional face-to-face purposes were being used for eLearning. Though it could be assumed that the courses have clear objectives and content, clearly aligned with the set of objectives, they don't have relevant graphics, and they do not incorporate relevant features required for eLearning purpose. In addition, the teaching method selected for the course does not incorporate the different media required to deliver a clear understanding of the course. The method of delivery was also not specific and appropriate to each module in the course. Apart from the above, there were no online and teaching-learning support facilities in the e-course. Online and teaching-learning support for giving directions on how to read, taking notes and manage stress were not incorporated as part of the course. The courses were not also designed as per the role of instructors (facilitator or main actor). Instructors' role as facilitator or main actor is critical to the design the course. In the case of Adama (ASTU), as was mentioned above in the institutional building block, the development of e-courses was started in the department of engineering, but has since been interrupted.

Regarding the **technology building block**, all three universities have fulfilled almost all the hardware and software requirements for eLearning. One of the interviewees from Arba Minch said that almost all technology requirements have been addressed or fulfilled. The student-computer ratio was very good for master's level students but this was still a challenge for undergraduate level students because there are far more undergraduate students than there are masters' students. Likewise, a respondent from Jimma University said that the problem of student-computer ratio for undergraduate students was being solved because the majority of students have laptops. Furthermore, the eLearning system of these three universities incorporate different aesthetic features to attract users to use the system, they still do not consider the social and language differences of users'. While there was some form of technical support to help users log into and out of the system and to upload and download files, this support came from the course instructor and not from separate technical staff. In addition, there were no people available to help the learner to start working with the eLearning system. There was also no clear and practical plan to budget for hardware, software and the other requirements of eLearning.

With regard to the **management building block**, both JU and AMU were good at managing the distribution of information, and managing course content. The information distribution and course content management systems at ASTU were also good, albeit at a lower level of performance as compared to JU and AMU. Schedules, announcements, grades and other course related information were disseminated through the eLearning system. Furthermore, transferring the right course to the right student was well managed during the implementation of eLearning. However, respondents were not sure whether each course was designed by the appropriate teacher or whether the appropriate instructor was assigned for the right course or not. The course content was also secured and could not be damaged or used by unauthorized users.

Regarding the **culture building block**, all the selected universities scored poorly in incorporating the culture component in the eLearning system. As one of the respondents from Arba Minch University pointed out; the system considers all users to have come from the same social, economic, language and political background. No diversity was catered for. The objective of all three universities was simply on transferring of courses. They did not consider that there are social, economic, political and language diversity among learners. As a result,

they do not develop e-courses and teaching materials taking all those differences into consideration. Students from different social backgrounds may not have the same style of learning. Students from different economic back grounds, from rich or poor backgrounds, may not have the same understanding for various components of the course. The same may also true for other cultural components such as politics and language. Hence, the institutions have to consider all these elements in order to enhance individualised learning through an effective teaching-learning process.

Regarding the **ethics building block**, the status of the three universities are the same but not good. As one of the respondents said, it is assumed that the system provides equal chance of information access by students. The system allows even the disadvantaged in society to actively participate in the system; but the system was not designed by taking the different skills-gaps of users into consideration. Geographic diversity was also not an issue in the selected universities, because there was no attempt to teach students who were living in diverse geographic situations. Legal issues have also not been considered by the three universities. They did not appear to place any emphasis on this issue, because of other priorities. The three institutions also did not emphasise the ethics element. This researcher believes that this may be because the technology, institutional and pedagogy building blocks were not yet matured enough, and their emphasis may have been on maturing those key building blocks.

For the **evaluation building block**, the student evaluation system was active in all selected universities though there was disparity in its usage. At JU and AMU, some motivated instructors were using the system, but at ASTU, the system as a whole was not active at the time the research took place. Regarding learning environment evaluation, none of the universities were using the system for evaluation of the learning environment including evaluating the course development process, evaluating the effectiveness of the eLearning system and others. As some of the respondents said even the exams were conducted online by some of the teachers who were enthusiastic enough to use the system.

- **Application of the taxonomy tree for the selected cases**

Application of the taxonomy tree on the three Ethiopian universities, JU, AMU, and ASTU will be discussed below.

A. Case of JU

The overall assessment result of the eLearning practice in JU shows that the existing eLearning practice in JU encompasses: technology (T), institution (I), pedagogy (P), management (M) and evaluation (E) building blocks. With the exception of the evaluation building block, which had a score of two (2), the other four building blocks achieved a weighted score above six (6). The remaining two building blocks of the generic learning framework; the culture and ethics building blocks were clearly not being practices at JU.

It can be concluded from this assessment that the eLearning framework in practice at JU is more prone to the technology building block, with a weighted score value of 12.65. This is followed by the institutional readiness building block 9.64, and the pedagogy building block, with a weighted score of 8.2. The management and evaluation building blocks achieved a score of 6.3, and 1.3 respectively.

Thus, the score factor, or the maturity level, of the framework as a whole is calculated to be 2.37. This places JU in the Basic level of maturity; between second and third from the bottom. By identifying the maturity level of their eLearning framework, the institution is able to identify where the gaps exist in their eLearning practice in general, and in each of the building blocks in particular.

In addition, it enables the institution to improve the weight and performance of the existing building blocks, and the maturity level of the framework as a whole. The goal being to achieve maturity level 5. Furthermore, the institution is expected to plan to integrate the remaining two building blocks with the existing building blocks so as to enhance the performance of the eLearning framework to the optimal level; indicated in the taxonomy tree by the branch with the red colour. Figure 8-2 illustrates the location of the JU eLearning framework in the taxonomy tree.

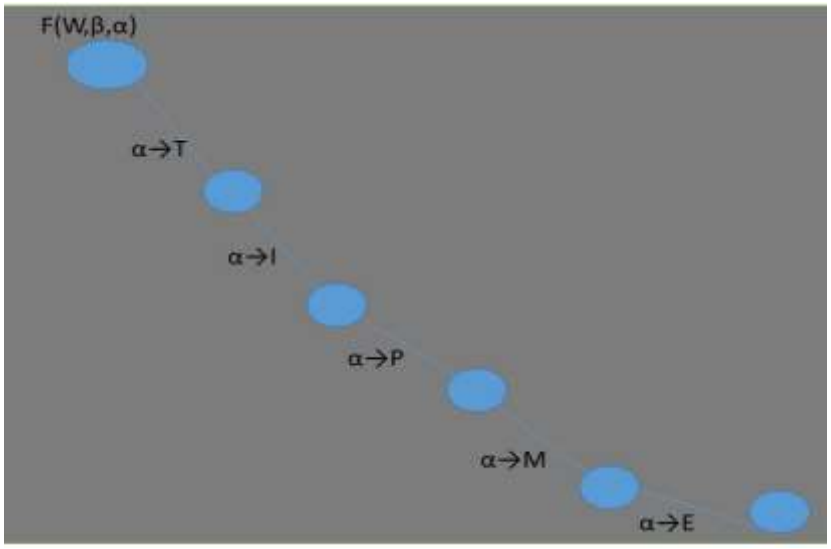


Figure 8-2:JU's eLearning framework in the taxonomy tree

To enhance the maturity level of the existing eLearning framework in general and the weighted score value of each of the building blocks in particular, this researcher suggests Jimma University should implement the following:

- First and foremost, the institution is expected to enforce development of **eLearning policy.** This includes:
    - more training to make users of eLearning skilled as well as to make users interested in using the system.
    - the allocation of funds so as to allow instructors to attend conferences and do research regarding eLearning. There should also be incentives for instructors to make them active participants in the e-course development process and to make their students interested in using the system. The institution is also expected to facilitate the registration and application process by integrating the application and registration system, as well as payment facilities, with the eLearning system.
    - Furthermore, student-computer ratio should be balanced and internet connection should be sustainable.
    - Above all, library, bookstore and counselling services should be incorporated in the eLearning system. The aforementioned suggestions should enhance the weighted score value of the institutional readiness building block.

- Furthermore, the interface of the eLearning system should be user friendly and should be capable of minimizing error and reducing usage time. These and others will enhance the weighted score value of technology.

- In addition, the institution should enhance the weighted score value of the **Technology building block**. As it is surveyed, the existing technology building block is used mainly to upload and download courses but not for other services like registration and payment. It is only used to transfer courses online. So, to get rid of the problems related to technology building blocks, dedicated technical staff should be there to facilitate usage of the technology.
- The institution should also enhance the weighted score value of the **pedagogy** building block by arranging a program that can facilitate pedagogically accepted e-course development. The quality of the courses being transferred through the eLearning system should be higher than comparable courses delivered face-to-face, because in online learning, teachers are not available to the students all the time. Among other things, a mixture of media in the learning environment, the appropriate method for delivering the content of each course, online support facilities and other pedagogical philosophies should be given attention during the design of the courses.
- Regarding the **management** building block, the institution should have a way to make the information being transferred secured. Users of the eLearning system should be capable of logging in and out, uploading and downloading files and data, as well as viewing the system easily. Schedules and announcements should be transferred easily to the right users through the eLearning system. The aforementioned and other related suggestions should enhance the weighted score value of the management building block.
- At JU, despite the activeness of the system for evaluating students' academic performance, only some motivated instructors are using it. A plan should be put in place to encourage all teachers and instructors to use the system. In addition the **evaluation** system for the learning environment should be active for users' and the institution should encourage use of this evaluation facility to get feedback for the improvement of the eLearning environment.
- Above all, the **culture and ethics** building blocks should be given emphasis. The social, economic, political, language and religious diversity of eLearning users should be

considered while preparing courses as well as selecting methods to teach the courses. In addition, equal access should be enhanced by filling digital gaps among users. A mutual respect policy should be developed for group discussion purposes. The above-mentioned suggestions should enhance the weighed score value of those building blocks and the overall maturity of the framework.

B. Case of AMU

Based on the assessment made at AMU, technology, institutional readiness, pedagogy, management and evaluation were identified as building blocks of the existing eLearning practice. As per the calculated result of the weighted score as well as the maturity level of the framework, the Technology, Institutional readiness, Pedagogy, Management and Evaluation building blocks have the weighted score values of 11.7, 10.5, 8.8, 5.72 and 1.4 respectively. Based on these weighted score results, the maturity level of the framework was calculated to be 2.28, which is low, and is in the range between basic and defined maturity level. These building blocks can be located in the taxonomy tree hierarchically from the highest weighted score value to the lowest. The existing eLearning framework of AMU is located in the taxonomy tree as illustrated in Figure 8-3.

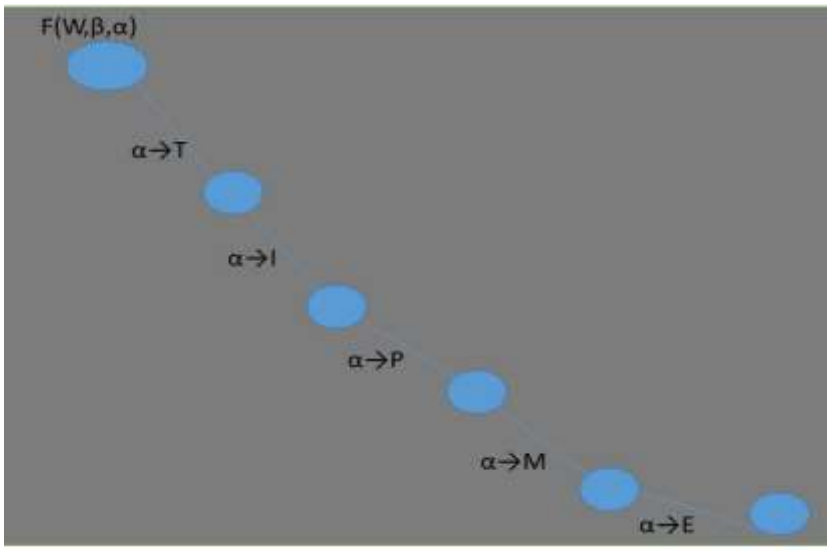


Figure 8-3: AMU's eLearning framework in the taxonomy tree

It can be concluded from the calculated result, that the existing eLearning framework only contained five of the building block of the generic eLearning framework, all with low maturity. Two of the building blocks, culture and ethics, have not been given attention, and have been excluded. Thus, the institution should plan to enhance the maturity level of the

existing framework in general, and the five building blocks in particular, up to maturity level five, which is optimal. Furthermore, the building blocks that have not yet considered should be given attention in order to reach the required high maturity level.

Furthermore, all the measures that have been recommended for improving the maturity level of the existing JU eLearning framework should also apply in the case of AMU.

C. Case of ASTU

The ASTU assessment result has identified that the technology, pedagogy, institutional readiness, and management building blocks were being practiced as part of their eLearning framework. The weighted score value of technology, pedagogy, institutional readiness and management are 10.5, 9, 8.2 and 2.6 respectively. Thus, it showed that the existing framework was more prone to technology which has the highest weighted score value. Next to this, the institution building block was given attention. Pedagogy followed by management building blocks have also been considered. The overall maturity level of the existing eLearning framework was found to be 2.02 which rests on the level basic in the hierarchy of maturity. Based on this result it can be concluded that ASTU would have to do a lot of work to enhance the weighted score of each of the existing building blocks and consequently, the overall maturity of the framework to the level 5. Furthermore, the institution should give attention to the culture, ethics and evaluation building blocks that have not yet been considered in the existing eLearning system. In addition to integrating those building blocks with the existing system, their maturity should also be improved.

The existing eLearning framework of ASTU is located in the taxonomy tree as illustrated in Figure 8-4:

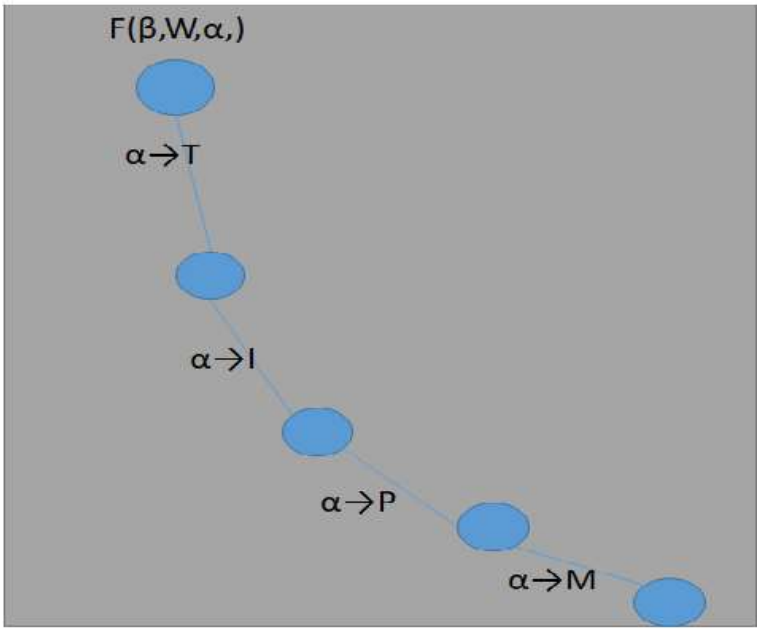


Figure 8-4: ASTU's eLearning framework in the taxonomy tree

To improve the weighted score value of the technology building block, the student-computer ratio should be enhanced to the level 1:1.There should also be enough budget for hardware and other requirements of eLearning. There should be an adequate number of suitably skilled technical support staff to support the implementation of eLearning. Furthermore, usable and user-friendly interfaces should be designed. Likewise, the weighted score value of the Institution building block should be enhanced, by providing sufficient training for eLearning users, and by giving incentives and funds for those who are actively participating in the implementation of eLearning.

In addition, policies and guidelines that can guide implementation of eLearning should be developed. Furthermore, services such as registration and application, library and book store, and orientation and counselling should be integrated with the existing eLearning system. The institution should also provide quality management that can facilitate proper usage of the system. ASTU should also enhance the weighted score value of Pedagogy and Management building blocks by arranging an e-course development program that focuses on quality of e-courses through using different media and course design in the teaching method. Announcements, grades, and assignments should be transferred in a secured way.

Above all, ASTU should work hard to integrate culture, evaluation and ethics building blocks with the existing building block. These recommendations and others should enhance the maturity level of the eLearning framework at ASTU

8.3 Chapter Conclusion

The aim of this chapter is to examine the obtained data in order to be able to draw a conclusion regarding the extent to which eLearning was being practiced in the selected Ethiopian higher learning institutions. Another objective is to identify where the existing eLearning frameworks were located in the taxonomy tree, as proposed in Chapter 5. This chapter also aims to achieve the research objective: **Perform an evaluation and validation of the taxonomy tree**.

To achieve this, a survey is conducted of the current eLearning practices at three Ethiopian universities, JU, AMU, and ASTU. The results of this survey is used to identify and evaluate the building blocks in each of the eLearning frameworks, determine their maturity levels and overall eLearning framework maturity and locate the position of each of the selected institutions on the taxonomy tree. This researcher then makes recommendations for improvements based on the survey results.

The main deliverable of this chapter is the assessment result of the current eLearning practice in the three Ethiopian higher learning institutions that had been purposefully selected. Additional deliverables included an evaluation of the results and recommendations for improvement.

9 CHAPTER NINE: SUMMARY, FUTURE WORK AND RECOMMENDATIONS

9.1 Introduction

This chapter seeks to elaborate and demonstrate that all the sub-research objectives defined in the first chapter were answered throughout the various chapters. In doing so, it will be proven that the thesis's main objective has been achieved, and thus the thesis's main research question answered.

The main objective of this study is to develop a taxonomy of eLearning frameworks represented in the form of a taxonomy tree. The developed taxonomy forms the basis for the identification of the appropriate node on the tree pertaining to a learning institution as a result of its maturity assessment. The outcome of the assessment was used to follow a methodology for eLearning adoption and thereby improve the institution's maturity on its currently adopted eLearning framework.

This chapter is structured as follows: section 9.2 summarizes and presents findings of the research. Section 9.3 presents the output of the research; section 9.4 presents the benefits or contribution of the research output. Section 9.5 discusses future work, and section 9.6 discusses summary and recommendations.

9.2 Summary of Chapters

This division of the chapter provides a summary of each chapter of the study. The research objectives and research questions as well as their corresponding chapters are summarised in Table 9-1:

Table 9-1: Summary of the research objectives, research questions and their corresponding chapters

List of Research Objectives	List of Research Questions	List of Chapters
RO1: Investigate education systems and their alignment to eLearning.	**RQ1:** What are existing education systems and how are they aligned to eLearning?	**Chapter 2**: Explores the literature on basic terms of education system, eLearning as well as the current status of education system and their alignment with the eLearning system in the world.
RO2: Explore and study eLearning frameworks and models.	**RQ2:** What are existing eLearning frameworks and models in the literature and their characteristics?	**Chapter 3:** Explores the literature on eLearning frameworks and models
RO3: Develop a generic eLearning framework and a methodology for eLearning framework adoption.	**RQ3:** How are a generic eLearning framework and a methodology for eLearning adoption developed?	**Chapter 4**: provides a generic eLearning framework and a methodology for eLearning adoption
RO4: Develop a taxonomy of eLearning frameworks	**RQ4:** How is a taxonomy of eLearning frameworks developed?	**Chapter 5:** Provides a taxonomy tree
RO5: Perform evaluation and validation	**RQ5:** How are the proposed generic framework, methodology and taxonomy evaluated and validated in a real-life context of Ethiopian learning institutions	**Chapter 6:** provides data collection **Chapter 7 and Chapter 8:** provides data analysis, validation, improvement and demonstration

The main objective of the research is to develop a taxonomy of eLearning frameworks. This taxonomy forms the basis for the identification of the appropriate node from the tree relating to a learning institution as a result of its maturity assessment. The outcome of the assessment can thus be relied upon to follow a methodology for eLearning adoption and thereby improving the institution's maturity of its adopted eLearning framework.

Table 9-1 provides an overview of the research by showing each of the objectives and their equivalent research questions as well as the answers that enable this researcher to achieve the research objectives. The chapters that discuss each of the research objectives and questions as well as the deliverables are also stated in the table above.

The first objective is to investigate education systems and their alignment to eLearning. It lead to the literature review on the definition of the terms such as education, education theory, education system and eLearning. The status of higher education and technology are also the other points reviewed in Chapter 2. This chapter also discussed the current status of the education system in some selected developed and developing countries. Furthermore, discussion on the alignment of the current education system with the eLearning system was done. The status of eLearning in some developed and developing countries was also discussed. Generally, the outcomes of the chapter included the definition of basic terms and status of education systems, as well as eLearning systems of some selected developed and developing countries. Above all, alignment of education system with eLearning system was also demonstrated in this chapter. These outcomes are considered as a base for identification of a plethora of eLearning frameworks and models.

The second objective is to explore and study eLearning frameworks and models. This objective is addressed in Chapter 3 by answering the research question: "What are existing eLearning frameworks and models in the literature and their characteristics". This necessitates investigation of literature on the definition and characteristics of eLearning frameworks and models. Some preliminary classification of eLearning frameworks is also done.

The third objective is to develop a generic eLearning framework and a methodology for eLearning framework adoption. This objective is addressed in Chapter 4. It was achieved through answering the research question: "How are a generic eLearning framework and a methodology for eLearning adoption developed?" Answering this question necessitates investigation of the literature on the definition of preliminary concepts such as frameworks, building blocks, components, elements, weight of an element, metrics, and maturity. Identification of common building blocks that could make up a generic eLearning framework and characterisation of the generic eLearning framework was also studied. Chapter 4 also included exploitation of the generic eLearning framework for the derivation of existing eLearning frameworks. The output of the literature review and analysis results in ways of maturity assessment on eLearning frameworks. The other major output of Chapter 4 is the development of a methodology for eLearning adoption and its application in a real-life situation.

The fourth objective is to develop a taxonomy of eLearning frameworks. This objective is realised in Chapter 5 through answering the research question:" How is a taxonomy of eLearning

frameworks developed?" Answering this research question required exploration of literature on overview of taxonomy and taxonomy development (definition and history of taxonomy). Furthermore the taxonomy tree was developed and its application in real-life is demonstrated in Chapter 5.

The fifth objective is to perform evaluation and validation**.** This objective is accomplished in Chapters 6, 7 and 8 through the answers provided by the research question:

"How are the proposed generic framework, methodology and taxonomy evaluated and validated in a real-life context of Ethiopian learning institutions?"

The answers to this research question required data collection from eLearning experts and eLearning users by using data collection instruments such as questionnaires, questionnaire-structured interviews and telephone interviews. The collected data is analysed and, the generic eLearning framework as well as a methodology for eLearning adoption are improved. These improved versions are then presented as the output of Chapter 7. Furthermore, in Chapter 8, the current eLearning practice was analysed and the taxonomy tree was used to locate the status of the universities for further maturity assessment.

9.2.1 Chapter 1 Summary

This chapter introduced the whole rationale for the research; why the research was done, what was done, where and when it was done, as well as how the research was done.

The knowledge economy and expansion of higher education made eLearning a choice of necessity. As a result of increased interest and demand, and a proliferation of eLearning frameworks designed in the interests of the vendors supplying the network, and as a result, there is no consolidated view, and a lack of scientific understanding about the characteristics and relationships of each framework. This has made the selection of an appropriate eLearning framework for a particular context a challenge.

The objective of this research is therefore to develop taxonomy of eLearning frameworks to make selection of appropriate eLearning framework easy. In doing so, the development of generic eLearning framework, a methodology for eLearning adoption and assessment of the current eLearning practice became important. The focal question of this research is: How can taxonomy of eLearning frameworks and models be built? The research methodology used in this research

includes literature reviews, analysis, designing and modelling as well as survey-based case study. Design science method is the most important approach to develop and evaluate artefact. Thus, it is adapted for the purpose of this research. The main scope of the study presented in this research is to develop taxonomy of eLearning frameworks as a benchmark for selection of appropriate eLearning framework.

9.2.2 Chapter 2 summary

Chapter 2 reviews literature on the preliminary concepts of the research such as the definitions of education, education system, educational theories and eLearning. The status of the current education system and eLearning in the world are also discussed. There is also a discussion on the impact of technology on the existing education system in general and higher education in particular. The impact of educational theories on the current eLearning system is well articulated in this chapter. An attempt to answer the research question: What are existing education systems and how are they aligned to eLearning? is made in this chapter. The complete summary is discussed as follows.

Education has been referred as a system since it encompasses different interdependent components that can work together towards the achievement of educational goals. As was reviewed from the literature, the education system in developing countries are different structurally and in the language of instruction they are using, but they share some common challenges such as large class sizes, scarce resources, scarce and untrained, as well as demotivated teachers, poor English language skills, teacher-centered classrooms and the like. On the other hand, though developed countries have similar challenges, they are minimising and overcoming them. Some dominant problems of developed countries are lack of equal educational access among the disadvantaged and advantaged group of society, and low achievement in the international tests of courses. Regarding learning theories, behaviourism and cognitivism are the dominant learning theories in developing countries, whereas, the practice in the developed nations has shifted to constructivism; a more active, participant-based learning. Here there has been a paradigm shift from considering the learner as information processer (cognitivist) to active learner. In line with this, as has been witnessed from various literatures, active learning can be achieved in technology-assisted learning.

Also reviewed in Chapter 2 is that eLearning is unavoidable in this age of knowledge economy. There are many different definitions of eLearning in the literature, but the following one was thought to be the most inclusive.

"Any sort of learning that is facilitated by electronic communication (using ICT) is referred to as eLearning."

Apart from the challenge in implementing eLearning, especially in developing countries, it has some educational, social and economic benefits such as enhancing students' achievement, minimising digital gaps and saving money.

Also reviewed in this chapter are factors affecting effective learning that could also influence effective eLearning. Thus, system quality, information quality, service quality, use, user satisfaction, and net benefit could be considered as factors that determine success of eLearning.

In Chapter 2, it was also pointed out that the diversified nature of the higher education system in the world resulted in diversified eLearning systems.

9.2.3 Chapter 3 summary

Chapter 3 concerns the definition and characteristics of various eLearning frameworks and models found in the literature. It gives attention to the identification of the possible existing eLearning frameworks and models as well as their characteristics. The detailed summary of the chapter is discussed below.

An eLearning framework is an overview, or an outline, of how the eLearning system is developed, delivered, managed and evaluated, whereas an eLearning model is more like an architectural representation of an eLearning system and it is technology centric as well as a miniature that shows how the system is going to be constructed.

For the purpose of this study, the models are discussed in terms of the frameworks that they relied on (based) since the focus of this research is on the frameworks not on specific models. Khan, orbital, blended, and comprehensive frameworks were among the eLearning frameworks mentioned in this chapter, and they all contain some common building blocks like technology, institution, pedagogy and culture. The demand-driven learning model, adjunct, synchronous, asynchronous and pedagogic models are among the eLearning models mentioned in this chapter

and they were presented as more architectural and technology centric. They focus on how the learning is delivered rather than on how the course is designed, and how all the necessary infrastructures are established and managed. The models only emphasise which technology is being used to simplify teaching-learning. This chapter discusses the eLearning models in terms of their underling frameworks because the focus of this research was on the frameworks not on the models.

The preliminary classification of eLearning models and frameworks is also presented in Chapter 3 so as to initiate further classification activity.

9.2.4 Chapter 4 summary

In chapter four, the literature reviewed in Chapter 2 and 3 is analysed and a generic eLearning framework has been proposed with the intention of having a consolidated view of various eLearning frameworks that have been developed. A methodology for eLearning adoption is also proposed to guild the adoption process of eLearning. This chapter is further summarised as follows.

Preliminary concepts of eLearning frameworks such as elements, components, building blocks, a framework, metrics, weights, score factors are defined. Common and relevant building blocks of eLearning frameworks such as institution, pedagogy, technology, culture, management, evaluation, interface, ethics etc. are also identified from the literature and included as part of the generic eLearning framework with some modification. In line with this, list of some metrics so as to evaluate building blocks, component and elements are also identified. Among others, the number of errors that the software generates, percentage of student-computer ratio, and number of instructors who took training aree some examples of the metrics proposed in this chapter. The chapter is also a demonstration of how weights of some elements, components and building blocks were assigned.

Furthermore, derivation of some existing frameworks based on the generic eLearning framework was done. Formulas to calculate framework maturity are also proposed in this chapter.

In Chapter 4, a methodology for eLearning adoption is also proposed and applied in real-life situation.

9.2.5 Chapter 5 summary

Chapter 5 offers a taxonomy of eLearning frameworks through taxonomy tree. The taxonomy tree enables higher learning institutions to select appropriate eLearning framework. The sub-contents this chapter addresses the overview of taxonomy and taxonomy development, and a proposed taxonomy for eLearning frameworks. The detailed summary follows:

There are several definitions of Taxonomy in literature. Among others, the following definition was considered as appropriate so as to realize the central objective of this study:

"Taxonomy is beyond classifying observations; it is also about clarifying the relationships among classes of phenomena"

In earlier times taxonomy, was more popular in the fields of biology and library science. It has now become more common in fields like information systems. Different types of taxonomies namely: list, tree structures, hierarchies and the like were discussed in this chapter. Among others, the tree structure was selected for the purpose of this study. In the tree structure, branches distinguish broad and specific categories. The structure can also be used to display cause and effect relationships. It is mostly used when concepts need to be sub-divided into subcategories based on well-understood and agreed-upon criteria, as well as when lists grow too long. The foregoing features made the tree structure appropriate for this study.

Conciseness, inclusivity, comprehensiveness, extensibility are mentioned as basic attributes of taxonomy. The two basic methods of taxonomy development; manual and automatic are discussed in this chapter. Manual taxonomy should be done by experts in a particular domain. Domain experts choose terminologies, synonyms and order of concepts. This method has the advantage of human decision-making as well as being the most common approach to taxonomy development. In this research, the manual approach is used because of its advantages over automatic.

Bailey's three-level approach to taxonomy development is discussed and it is partially followed by this research. Finally, the taxonomy construction process and taxonomy tree are proposed. Furthermore, application of the taxonomy tree in the real-life context is also presented.

9.2.6 Chapter 6 summary

Chapter 6 deals with data collection. It presents the scene how data is collected for the validation of eLearning frameworks, and a methodology for eLearning adoption so as to determine whether

the conceptualisations could work in a real-life context or not. It also deals with how data is collected for the purpose of understanding the current status of eLearning in three selected Ethiopian higher learning institutions. The details of the chapter are discussed as follows.

In this chapter the populations of the study are identified. Ethiopian higher learning institutions that were practicing eLearning are considered as the population for the study. Among them, some were selected using random and purposive sampling techniques because of travel, money and time constraints. Then, because students and instructors could be considered to be direct sources of information, they are selected using random and purposive sampling. Furthermore, some experts all over the world were selected randomly and consulted about the framework and the methodology. The data collection instruments used included: questionnaires, interviews, observation and document analysis.

This chapter also discusses the instrument used for testing validity and reliability as well as how validity and reliability tests are done.

9.2.7 Chapter 7 summary

Chapter 7 deals with data analysis and discussion. This chapter was planned to achieve part of the research objective: "Validate the generic eLearning framework as well as a methodology for eLearning adoption in a real-life context of Ethiopian learning institutions and improve them". The outputs of this chapter are an improved generic eLearning framework and an improved methodology for eLearning adoption.

To this end, the data analysis techniques used to analyse the collected data include descriptive, confirmatory factor analysis and thematic analysis. The responses of the questionnaires are analysed quantitatively using descriptive analysis methods with the help of SPSS V-25. Whereas, the responses from the interviews, observations and document analysis are analysed qualitatively using thematic analysis methodology with the help Atlas.ti 9 and Excel 2010 tools. Furthermore, the measurement model tests are also done through confirmatory factor analysis. The measurement model helped to validate the questionnaire items; how well the indicator variables (components) determined the latent variables (building blocks).

The chapter discusses the validation results of generic eLearning framework and a methodology for eLearning adoption. After which, improvements to both of the artefacts are also suggested in

the chapter. According to the experts as well as users of eLearning, the proposed generic eLearning framework is inclusive of all relevant eLearning implementation issues, but some of the building blocks were too broad and became too vague for the users to understand. Thus, some renaming of building blocks, and giving emphasis to some very relevant but hidden components, became important. Furthermore, iteration to and from the metric knowledge base to the other seven building blocks is suggested as being essential. The metrics from the knowledge base are used to evaluate the maturity of each of the building blocks, and knowledge from the evaluation results are used as inputs to the knowledge base.

With regard to methodological steps for eLearning adoption, both the experts', as well as users' believed that it is all inclusive, but the improved version should have an iterative nature. The respondents agreed on the relevance of all the steps of the artefact although some of the respondents wanted to give emphasis to some activities in the steps. Thus, the improved version only included the addition of the iteration from the last process step to the first.

Finally, the outcomes of the measurement model tests show that the latent and indicator variables have a positive relationship. The results of Cronbach alpha measure, composite reliability and average variance extracted, were above 0.7, 0.7 and 0.5 respectively. These results are beyond the recommended threshold.

9.2.8 Chapter 8 summary

Chapter 8 presents and discusses the case study on the assessment of the current eLearning practice in some selected Ethiopian higher learning institutions and demonstrates the application of the taxonomy tree for a particular learning institution. The detail of the chapter is discussed below.

The assessment of the current practice of eLearning is done on three purposively selected cases namely: JU, AMU and ASTU. The questionnaire was uploaded to Google documents so as to address eLearning users: instructors', ICT experts' and students' who were widely spread geographically. A total of 85 instructors and 211 students were selected to be respondents. Interviews were conducted with 20 ICT directors' and instructors' from the three institutions, using a structured interview questionnaire uploaded to Google documents. The responses from the questionnaires were analysed using descriptive analysis techniques and SPSS analytical software.

The qualitative responses from the interview were analysed using Atlas.ti qualitative analysis software and Excel.

The result of the analysis shows that the status of eLearning in all of the selected universities in Ethiopia is almost similar. They are all in the infant stage. The technology building blocks of the eLearning system in all of the three selected universities is almost at a mature status, with some limitations, such as an unbalanced student computer ratio in some programs, and the lack of sustainable power supplies and Internet access. On the other hand, the pedagogy, institutional readiness and some management building blocks does exist, but not at a mature status. There is an attempt by the institutions to develop policies and curriculum, and to distribute information through the eLearning system, but these had not been progressed sufficiently. None of the universities selected for inclusion in the study have given much attention to implementing the Culture, Ethics and Evaluation building blocks of the generic eLearning framework.

Regarding application of the taxonomy tree, this researcher locates the position of the selected institutions in the taxonomy tree, and makes suggestions for how the institutions could improve the maturity levels of their existing eLearning frameworks.

9.3 Output of the Research

The outputs of the research in general were presented in each chapter in the form of lists and tables as well as diagrams. They are summarised below:

- A high-level comparison of education systems as well as eLearning systems in developed and developing countries.
- Production of a significant list of eLearning frameworks and models as well as their characteristics.
- Production of a conceptualisation of a generic eLearning framework using well defined constructs such as building blocks, components and elements as well as metrics for measuring the maturity of those constructs.
- Development of a methodology for eLearning adoption.
- Development of a taxonomy tree for the classification of eLearning frameworks (existing and non-existing).

- Demonstration of how an eLearning framework can be located in the developed taxonomy tree and how an institution's maturity assessment was done.

Above all, some of the outputs were delivered through publications. The following table shows list of publications.

Table 9-2: List of Publications

Authors	Years	List of publications
Zebiba Ali Abegaz E Ketcha Ngassam	2015	Z. A. ABEGAZ and E. K. NGASSAM. "Preliminary classification of eLearning models." 2015 IST-Africa Week Conference (IST-Africa), Lilongwe, Malawi. ISBN: 978-1-905824-50-2
Zebiba Ali Abegaz E Ketcha Ngassam	2019	Z. A. ABEGAZ and E. K. NGASSAM, "A Generic Framework for eLearning Adoption," *2019 IST-Africa Week Conference (IST-Africa)*, Nairobi, Kenya, 2019, pp. 1-9, Doi: 10.23919/ISTAFRICA.2019.8764857

9.4 Benefits or Contributions of the Research Output

The research outputs, which include a generic eLearning framework, a methodology for eLearning adoption, and a taxonomy of eLearning frameworks, provides a variety of practical contributions. First and foremost, the taxonomy tree has been developed to guide institutions in having a consolidated view of all existing and new (future) eLearning frameworks. As a result, it makes selection of appropriate eLearning frameworks easy.

Secondly, the developed taxonomy will assist institutions to evaluate the maturity level of their existing eLearning framework and enable them to work hard to bring the maturity of their eLearning framework to the required level as indicated in the taxonomy tree.

Thirdly, the developed taxonomy can be used as a tool for institutions in their understanding of the maturity level of the eLearning frameworks, and for them to know when optimal maturity has been achieved.

Fourthly, the developed taxonomy can be used as a means to advocate the most relevant building blocks required for effective implementation of eLearning.

Fifthly, the developed methodology for eLearning adoption can be used as a step-by-step guide for institutions to implement eLearning.

Sixthly, the characterisation of eLearning frameworks can be used as a tool to suggest the most relevant metrics needed to evaluate the maturity level of an eLearning framework.

9.5 Future Work

In this section, future research areas that are inspired by this research are indicated for the research community. The research areas that could not be covered by this research but which might be handled by other researchers are discussed below. These research areas are classified as postgraduate research of limited scope, Master's research (medium level) and PhD research (advanced level).

9.5.1 Postgraduate research of limited scope

- Assessment of the impact of taxonomy on the success of framework selection.
    - **Problem statement**: The role of the newly proposed taxonomy tree in selecting a suitable eLearning framework was not investigated empirically in this study.
- Assessment of the impact of the metrics on the success of assessing the maturity of the building blocks and the eLearning system.
    - **Problem statement:** There are no standardised metrics for the evaluation of the success of the building blocks for eLearning implementation.

9.5.2 Master's research (medium level)

- A study that can investigate the relationship between the building blocks and the success of eLearning implementation in some selected African countries.
    - **Problem statement:** The importance of the building blocks for the success of eLearning implementation in developed countries may differ from those required for the fruitful application of eLearning in developing countries' context.

9.5.3 Advanced level Project

- A study to further validate the generic eLearning framework in several African regions.
    - **Problem statement**: there are diverse education systems in different parts of Africa, so there is a need to validate the generic eLearning framework in different contexts.

- A study to further validate a methodology for eLearning adoption in different regions of Africa.
    - **Problem statement:** there is a need to validate a methodology for eLearning adoption in different part of Africa due to the diverse context that exists in different regions of Africa and diversified ways of adopting eLearning framework.

9.6 Summary and Recommendations

In this study the general objective of developing a taxonomy of eLearning frameworks was achieved. The frameworks that come prior to the taxonomy tree namely: generic eLearning framework and a methodology for eLearning adoption, have addressed all the issues relating to the implementation of eLearning. The major output of this study was the taxonomy that enables the observation of the relationship between all relevant nodes (building blocks) identified in the generic eLearning framework, as a distinguishing feature of existing eLearning frameworks.

The taxonomy tree is able to represent all the available existing eLearning frameworks as well as any eLearning frameworks that are going to be derived in the future. The tree provides a consolidated view of the plethora of existing eLearning frameworks, and in so doing, it makes the selection of an appropriate eLearning framework easier. The taxonomy tree enables learning institutions to assess their maturity level towards achieving effective implementation of eLearning. In the taxonomy tree, the line that starts from the root node and ends with the leaf node shows the highly matured eLearning framework that can perform to the optimum. This knowledge can provide institutions with the direction and path to follow in the process of maturing their eLearning framework. For example, if an institution has a strong or matured technology building block, but has ignored the other building blocks, it is suggested that the institution should work to mature the pedagogy building block. This process should be followed until all building blocks achieve the maturity level as shown in the leaf node.

Thus, it is recommended that the institution should assess its current eLearning practice and evaluate the status of the existing eLearning framework based on the knowledge in the taxonomy tree. Following this, the institution should work hard towards achieving the highest maturity of the framework as possible. An institution should be guided by the taxonomy tree while selecting and adopting an eLearning framework that best fits their requirement.

An institution should be guided by the taxonomy tree and the generic eLearning framework to understand what the maturity of eLearning framework means and how the maturity level of its eLearning framework is determined (calculated).

References

Abbott (2014). ‘Hidden curriculum.The glossary of education reform.’

Adeyinka, A. A. (1980). ‘The 6-3-3-4 education systems and the drive for self-employment in Nigeria.’, *IJEB*, 8(3).

Aguti, B., Walters, R. and Wills, G. (2013). ‘A framework for evaluating the effectiveness of blended e-learning within universities’, *Proceedings of Society for …*, (Unesco 2006), pp. 1982–1987. Available at: http://eprints.soton.ac.uk/369972/1/Beatrice Aguti Society for Information Technology & Teacher Education International Conference Paper_48392.pdf.

Aheto-Tsegah, C. (2011). ‘Education in Ghana – status and challenges’, *Commonwealth Education Partnerships*, pp. 27–30. Available at: http://www.cedol.org/wp-content/uploads/2012/02/Charles-Aheto-Tsegah-article.pdf.

Ahmed, M.U., Hussain, S. and Farid, S., (2018). Factors influencing the adoption of e-learning in an open and distance learning institution of Pakistan. Electronic Journal of e-Learning, 16(2), pp.148-158.

Ajadi, T. O., Salawu, I. O. and Adeoye, F. A. (2008). ‘E-learning and distance education in Nigeria’, *Turkish Online Journal of Educational Technology*, 7(4), pp. 61–70.

Al-Shalabi, H., Andraws, S., Alrabea, A.I. and Kumar, A.S., (2012). V model of e-learning using Gagne nine steps of education.

Al Musawi, A. (2010) ‘The Instructional and Learning Technologies Department in the College of Education, Sultan Qaboos University’, in M, O. (ed.) *Educational Media and Technology Yearbook, Volume 35 (AECT)., Association of Educational and Communication Technology*.

Alemu, B. M. (2017) ‘Transforming educational practices of Ethiopia into development and the knowledge society through information and communication technology’, *African Educational Research Journal*, 5(1), pp. 1–17. Available at: http://www.netjournals.org/pdf/AERJ/2017/1/16-050.pdf.

Alshaher, A. A.-F. (2013) ‘The McKinsey 7S Model Framework for E-Learning System Readiness Assessment’, *International Journal of Advances in Engineering & Technology*, 6(5), pp. 1948–1966.

Aluko, F. R. (2008) ‘A comparative study of distance and conventional education programmes assessed in terms of access, delivery and output at the University of Pretoria.’, *Dissertation Abstracts International Section A: Humanities and Social Sciences*, 68(9-A), p. 3711. Available at: http://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=2008-99050-527&site=ehost-live.

Alzaghoul, A. F. (2012) ‘the Implication of the Learning Theories on Implementing E-Learning Courses’, II(Ii), pp. 27–30.

AMU (2018). ‘eLearning in AMU’.Available at: 'www.AMU.edu.et'.

Andell, K. (2008) ‘A Country Divided: A Comparative Study of the German Education System Katelyn Andell August 20, 2008’.

Andrews and Richard (2011) ‘Does e-learning require a new theory of learning? Some initial thoughts’, *Journal for educational research online*, 3(1), pp. 104–121.

Aoki, K. (2010) ‘The use of ICT and e-Learning in higher education in Japan’, *World Academy of Science, Engineering and Technology*, 42(June 2010), pp. 854–858. doi: 10.5281/zenodo.1071140.

Asabere, N.Y. and Mends-brew, E., 2012. Distance Learning and Electronic Learning (E-Learning): Are They the Same? An Overview of Some Tertiary Institutions in Ghana 1.

Bauduy, L. (2008) ‘The education systems of Ethiopia.International Education Association of South Africa – IEASA 12th Annual Conference 27th – 30th August, 2008’.

Bauer, P. & K.-L. I. (2010) ‘“The Shift from Traditional Teaching and Learning Patterns to New Learning and Teaching Cultures. Improving Classroom Teaching at German Schools”’, in *World Conference on Educational Multimedia, Hypermedia and Telecommunications*, p. 1908.

Bélisle, C. (2008). ‘eLearning and Intercultural dimensions of learning theories and teaching models’, *eLearning Papers*, (7), p. 2.

Berhe, H. (2011). ‘the Challenges and Current Status of E- Learning in Ethiopian Higher Education Institutions: Case of Mekelle University’, p. 118.

Bhuasiri, W., Xaymoungkhoun, O., Zo, H., Rho, J.J. and Ciganek, A.P. (2012). Critical success

factors for e-learning in developing countries: A comparative analysis between ICT experts and faculty. Computers & Education, 58 (2), 843–855.

Bichelmeyer, B. A. and Hsu, Y. (1999) 'Individually-Guided Education and Problem-Based Learning: A Comparison of Pedagogical Approaches from Different Epistemological Views', *Proceedings of Selected Research and Development Papers Presented at the National Convention of the Association for Educational Communications and Technology*, p. 9p.

Charlton-Laing, C. and Grant, G. (2012) 'What are the dynamic capabilities needed for a National e-learning implementation? A Jamaican E-Learning Case Study', *GlobDev 2012*. Available at: http://aisel.aisnet.org/globdev2012/5.

Cohen L., Manion L.and Morrison K., (2009) 'Book Reviews Research Methods in Education (6th ed)', The A ustr alian Educational Researcher, (January 2000).

Cohen, L. M. and Morrison (2007). *Research Methods in Education*.

Collins Dictionary (2021) Educational system definition and meaning - https://www.collinsdictionary.com › dictionary › english).

Cooper, D. R. and Schindler, P. S. (2003). 'Business research methods', *Business*, p. 38. Available at: http://130.209.236.149/headocs/31businessresearch.pdf.

Dabbagh, N. (2005). 'Pedagogical Models for E-Learning : A Theory-Based Design Framework', *International Journal of Technology in Teaching and Learning*, 1(1), pp. 25–44. doi: 10.1007/s10796-009-9200-1.

Davies, J. (2004) 'Good practice guide : eLearning'. RCOG https://www.rcog.org.uk › globalassets › documents PDF.

De Freitas, S. (2004). 'JISC e-Learning Models Desk Study Stage 2 : Review of e-learning theories , frameworks and models', *Learning*, 202, p. 43. doi: citeulike-article-id:581298.

De Villiers, M.R., (2006). A learning theory approach in support of outcomes-based e-learning.

DeLone, W.H. and McLean, E.R., (2002), January. Information systems success revisited. In Proceedings of the 35th Annual Hawaii International Conference on System Sciences (pp. 2966-2976). IEEE.

Demiray, U. E. (2010) *Cases on Challenges Facing E-Learning and National Development: Institutional Studies and Practices. e-Learning Practices. Volume I., Online Submission*.

Demirgünes, S. (2017) 'Transition to Higher Education in the World and Turkey: Proposal for Transition to Higher Education', *Journal of Education and Practice*, 8(7), pp. 18–23. Available at: https://search.proquest.com/docview/1913345681?accountid=13031%0Ahttp://sfx.nelliportaali.fi/nelli28b?url_ver=Z39.88-2004&rft_val_fmt=info:ofi/fmt:kev:mtx:journal&genre=article&sid=ProQ:ProQ%3Aeric&atitle=Transition+to+Higher+Education+in+the+World+and+Tu.

Dlouhá, J., Heras, R., Mulà, I., Salgado, F.P. and Henderson, L., (2019). Competences to address SDGs in higher education—A reflection on the equilibrium between systemic and personal approaches to achieve transformative action. Sustainability, 11(13), p.3664.

EFA Global Monitoring Report UNESCO (2005). 'UNESCO's conceptualization of quality: a framework for understanding, monitoring and improving education quality', *Leonardo*, 8(4), p. pp 30-37. doi: 10.2307/1573042.

Eisenhardt, K. M. (1989) 'Building Theories from Case Study Research Published by : Academy of Management Stable', *The Academy of Management Review*, 14(4), pp. 532–550.

Eisenhardt, K.M., & Graebner, M. E. (2007). Theory building from cases: Opportunities and challenges. Academy of Management Journal, 50(1), 25–32.

Elameer, A.S. and Idrus, R.M. (2012).From Khan Octagon E-Learning to the Orbital E-Education, A New E-Education Framework for Iraqi Higher Education (IHE). Special Issue of the International Journal of the Computer, the Internet and Management, 19(2),1-8.

Elgort, I. (2005). 'E-learning adoption: Bridging the chasm', *ASCILITE 2005 - The Australasian Society for Computers in Learning in Tertiary Education*, (June), pp. 181–185.

Ethiopian Civil Service University (2018).Available at: 'www.ecsu.edu.et'.

European Association for the Education of Adults (EAEA) (2011). 'Country Report on Adult

Education in Finland'. Available at: http://www.eaea.org/country/finland.

Fredrick, F. T. (2015). 'prospects and challenges of e-learning in nigerian university education using national open university of nigeria akure study center.'

García-González, E., Jiménez-Fontana, R. and Azcárate, P. (2020). 'Education for sustainability and the sustainable development goals: Pre-service teachers' perceptions and knowledge', *Sustainability (Switzerland)*, 12(18). doi: 10.3390/su12187741.

Gazi, Z. K. (2013). 'on New Trends in Education and Their Implications (IJONTE)', *International Journal on New Trends in Education and Their Implications (IJONTE)*, 4(4), p. 214.

Georgieva, E., Smrikarov, A. and Georgiev, T., (2005), June. A general classification of mobile learning systems. In International conference on computer systems and technologies-CompSysTech (Vol. 8, pp. 14-6).

Ghaith, O. (2013). 'The Impact of Blended Learning on Female Student-Teachers in Kuwait A Thesis submitted for the degree of Doctor of Philosophy'.

Gyambrah, M.K., (2007). E-Learning Technologies and Its Application in Higher Education: A Descriptive Comparison of Germany, United Kingdom and United States (Doctoral dissertation, lmu).

Gunawardhana, L. K. P. D. (2020). 'Review of E-Learning as a Platform for Distance Learning in Sri Lanka', *Education Quarterly Reviews*, 3(2). doi: 10.31014/aior.1993.03.02.126.

Haddad, W. D. (2007). 'ICT-in- Education toolkit for policy makers, planners and practitioners 2007,version2.0.'

Hair Jr, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2013). *A primer on partial least squares structural equation modeling (PLS-SEM).* Sage Publications.

Hajjar, S. T. EL (2018). 'statistical analysis: internal-consistency reliability and construct validity Said Taan EL Hajjar Ahlia University', *International Journal of Quantitative and Qualitative Research Methods*, 6(1), pp. 27–38. Available at: www.eajournals.org.

Hanley (2005). 'Everything You Ever Wanted to Know about Taxonomies but were afraid to

ask.' Available at: Available at cloud.snappages.com ,accessed April 5, 2014%0A.

Hatsu, S., (2018). 'A framework for benchmarking e-governance projects in developing countries .'

Hodges, A. (2009). 'corporate e-learning : how three healthcare companies implement and measure the effectivness of e-learning by Submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Program of Instructional Leadership in the Gra'.

Hagos Y. (2019). 'E-learning Systems Success Model : The Case of Ethiopian Higher Education Institutions', *Addis Ababa University*, p. 308.

ICEF monitor (2018) 'study-projects-dramatic-growth-global-higher-education-2040'.

Jones, R.S., (2011). Education reform in Japan, pp. 99–140. doi: 10.1787/eco_surveys-jpn-2011-7-en.

Joshua, Nehemiah, M. and Ernest, M. (2015). 'A Conceptual Culture-Oriented e-Learning System Development Framework (e-LSDF): A Case of Higher Education Institutions in South Africa', *International Journal of Trade, Economics and Finance*, 6(5), pp. 259–265. doi: 10.18178/ijtef.2015.6.5.479.

JU (2019). 'Jimma university'. Available at: https://www.lucyacademy.com/ju/.

Kember, D. (2007). 'E-learning Focus of the chapter', pp. 157–166.

Ketema, T. and Nirmala, M. (2015). 'The Impact of E-Learning to Enhance Quality of Education : The Case of Adama Science and Technology University', *African Journal of Computing & ICT*, 8(1), pp. 155–162.

Khan, B. H. 2005 (2005). 'Managing e-learning: Design, delivery, implementation, and evaluation', *IGI Global. Information Science Publishing.*

Kibuku, R. N., Ochieng, P. D. O. and Wausi, P. A. N. (2020). 'e-Learning Challenges Faced by Universities in Kenya: A Literature Review', *EjEL*, 18(2).

Kothari, C.R., (2004). Research methodology: Methods and techniques. New Age International.

Kwofie, B. and Henten, A. (2011). ‘3 RD WORLD CONFERENCE ON EDUCATIONAL SCIENCES Bahcesehir University , Conference Centre Istanbul – Turkey Held on 3 rd February , 2011 Presenters Benjamin Kwofie & Prof . Anders Henten’, *WCES-2011 3rd World Conference on Education Sciences*.

Lee-Post, A. (2009). ‘e-Learning Success Model: an Information Systems Perspective’, 7(1), pp. 61–70.

Lin, J. (2008). ‘The difference between Western and Eastern education.’, pp. 1–14.

MacDonald, L. J. (2006). ‘"Curriculum Reform as a Reflection of Tradition and Change: Japanese Teachers Approaches to Dimensions of Difference via the integrated curriculum’.

Madar, M. J. and Willis, O. (2014). ‘Strategic Model Of Implementing E-Learning’, 3(5), pp. 3–6.

Maneschijn, m. M. (2005). ‘the e-learning dome: a comprehensive e-learning environment development model’, (June).

Marlow-Ferguson (2002). ‘Survey of Educational Systems Worldwide’, *World Education Encyclopedia.2nd Edition.* second.

Masoumi, D. and Lindström,B (2011). ‘Quality in e-learning : a framework for promoting and assuring quality in virtual institutions’, pp. 27–41. doi: 10.1111/j.1365-2729.2011.00440.x.

Mayes, T. and De Freitas, S., (2004). Review of e-learning theories, frameworks and models.

Mbengo, P. (2014) ‘E-learning Adoption by Lecturers in Selected Zimbabwe State Universities : An Application of Technology Acceptance Model’, *Journal of Business Administration and Education*, 6(1), pp. 15–33.

McInnes, R. J. (2018). ‘Sustainable development goals’, *The Wetland Book: I: Structure and Function, Management, and Methods*, pp. 631–636. doi: 10.1007/978-90-481-9659-3_125.

Mensah, J. (2020). ‘Improving Quality Management in Higher Education Institutions in Developing Countries through Strategic Planning’, *Asian Journal of Contemporary Education*, 4(1), pp. 9–25. doi: 10.18488/journal.137.2020.41.9.25.

Mirza, A. A. and Al-Abdulkareem, M. (2011). 'Models of e-learning adopted in the Middle East', *Applied Computing and Informatics*, pp. 83–93. doi: 10.1016/j.aci.2011.05.001.

Mlitwa, N. (2006). 'e-Learning and learning management systems (LMS) in a changing higher education environment', *Transforming IS & CS Education and Research in a Changing Higher Education Environment*. Available at: https://www.researchgate.net/publication/242292512.

MOE (2010.) 'Key competences for lifelong learning in Finland', *Education*, (May 2009), pp. 1–29. Available at: http://ec.europa.eu/education/lifelong-learning-policy/doc/natreport09/finland_en.pdf.

Mohammed, Z. Z. (2014). 'E-learning strategy in ministry of education in Kuwait's', International Journal of Advanced Science and Engineering Technology, 4(1), pp. 366– 372.

Motitswe, J. M. C. (2012).'Motitswe, J.M.C. 2012, "Teaching and learning methods in inclusive classrooms in the foundation phase",.'

Muhammad, D. N. P. H. (2009). 'A Critical Study of the Educational System in Brunei Darussalam in the Light of Al-Attas' Philosophy of Education.'

Nagarajan, D. P. and Dr.G.Wiselin, J. (2010). 'ONLINE EDUCATIONAL SYSTEM (e-learning) ', *International Journal of u- and e- Service, Science and Technology*, 3(4), pp. 37–48. Available at: http://www.sersc.org/journals/IJUNESST/vol3_no4/3.pdf.

Naturwissenschaften, D. Der and Beyene, B. (2010). 'A Model for an ePortfolio-based Reflective Feedback : Case Study of eLearning in Developing Countries', *Assessment*.

Neichter, E. N. (2003). 'Trends in Attrition, Delivery Methods and Instructional Methodologies in Introductory Health Information Management Courses, Spalding University.'

Nejad, M. B., Nejad, E. B. and Sadeghijoola, M. A. (2012). 'Overview on Models and Standards Classification in E-Learning System', 2(10), pp. 9784–9791.

Ngassam, E. K. (2015). 'Part II FA-based String Processing Algorithms', (August).

Nickerson, R., Muntermann, J., Varshney, U. and Isaac, H., (2009). Taxonomy development in information systems: Developing a taxonomy of mobile applications. In European conference in information systems.

Njagi, m. M. (2013). ‘assessment of the status of e-learning as course delivery method in public universities in kenya’, (june).

OECD (2013). ‘Education policy outlook: Ireland June 2013’, (June).

Ojo, O. A. and Adu, E. O. (2018). ‘The effectiveness of information and communication technologies (Icts) in teaching and learning in high schools in eastern cape province’, *South African Journal of Education*, 38(December), pp. 1–11. doi: 10.15700/saje.v38ns2a1483.

Olson, J. M., Codde, J. R. and Tarkleson, E. (2011). ‘An Analysis of e-Learning Impacts & Best Practices in Developing Countries With Reference to Secondary School Education in Tanzania USAID Africa Rising View project Impact of climate change and variability on crops in Africa View project’, (February 2015). Available at: https://www.researchgate.net/publication/272682458.

Olufemi, O.T., Adediran, A.A. and Oyediran, W.O., (2018). Factors affecting students’ academic performance in colleges of education in Southwest, Nigeria. British Journal of Education, 6(10), pp.43-56.

Patric L.,2007 (2008). Organizing knowledge: Taxonomies, knowledge and organisational effectivenes Rudak L.& Sidor *D*. Available at: http://www.ictinedtoolkit.org/usere/p_page.php?section_id=12.

Pakiso Joseph Khomokhoana, B. and Scientiae, M. (2011). ‘Using mobile learning applications to encourage active classroom participation: Technical and pedagogical considerations Dissertation submitted in accordance with the requirements for the degree’, (May), p. 200. Available at: http://scholar.ufs.ac.za:8080/xmlui/handle/11660/1082.

Panda, S.,& Mishra, S. (2007). E-Learning in a Mega Open University: Faculty attitude, barriers and motivators. Educational Media International. Educational Media International, 44(4), 323-338.

Patrick., L. (2007). ‘Organizing knowledge: Taxonomies, knowledge and organisational effectivenes’.

Pavelek, L., (2013). Approaches for selecting the correct research strategy: Differences between full time and part time students. In 1st International Virtual Scientific Conference (pp. 251-253).

Peffers, K. E. N., Tuunanen, T. and Rothenberger, M. A. (2008) ‘A Design Science Research

Methodology for Information Systems Research', 24(3), pp. 45–77. doi: 10.2753/MIS0742-1222240302.

Pellini, A. and Jones, H. (2011). 'Knowledge taxonomies: A literature review', (May).

Pillai, N. (2020). 'Reliability , Validity and Uni-Dimensionality : A Primer', (101714). Available at: https://mpra.ub.uni-muenchen.de/101714/.

Półjanowicz, W., Latosiewicz, R., Kulesza–Brończyk, B., Piekut, K., Niewiński, A. and Terlikowski, S.J., (2011). Comparative analysis of e–learning and traditional teaching methods in the fields of nursing and physiotherapy in the Medical University of Białystok. Progress in Health Sciences, 1(1), pp.96-103.

Qureshi, I.A., Ilyas, K., Yasmin, R. and Whitty, M., (2012). Challenges of implementing e-learning in a Pakistani university. Knowledge Management & E-Learning: An International Journal, 4(3), pp.310-324.

Rademaker, L. L. (2011). 'Qualitative research from start to finish: A book review', *Qualitative Report*, 16(5), pp. 1452–1455. doi: 10.46743/2160-3715/2011.1309.

Rajpal, S., Singh, S., Bhardwaj, A., Mittal, A. (2008) 'E-Learning Revolution: Status of Educational Programs in India', *Proceedings of the International MultiConference of Engineers and Computer Scientists 2008*, I, pp. 846–851.

Rashty, D. (1998). 'eLearning Processes Models', pp. 1–7.

Rehman, H. and Khan, D. N. (2014) 'Flaws in Pakistan's Educational System.', *Abasyn University Journal of Social Sciences*, 4(1), pp. 70–83. Available at: http://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=74740442&site=ehost-live&scope=site.

Rickards, J. (2000). 'The Virtual Campus: Impact on Teaching and Learning', *à l'International Association of Technological University Libraries (IATUL) Conference*, p. 7.

Rieckmann, M. Mindt, L. and and Gardiner, S. (2017). *Education for Sustainable Development Goals Learning Objectives*.

Rubenstein, I. Z. (2006). '"Educational expectations: How they differ around the world:

Implications for teaching ESL college students", Community College Journal of Research and Practice, vol. 30, no. 5-6, pp. 433-441.'

Salmons, J. (2019). 'Taxonomy of Collaboration Collaborative Work Design Examples'.

Saunders, M., Lewis, P. and Thornhill, A. (2012). 'Research Methods for Business Students. Pearson Education Ltd., Harlow.'

Saunders, M., Lewis, P. &Thornihill (2009). 'Research methods for business students.'

Saxena, A. (2013). 'A grape that sees another gets ripe: Some OER issues for the Commonwealth.', *Seventh Pan-Commonwealth Forum on Open Learning (PCF7), 2nd-6th December 2013, Abuja, Nigeria*, p. 7. Available at: http://pcfpapers.colfinder.org/handle/5678/112.

Seow, C., Hughes, J., Newton, D. & Ellis, A. (2005). '"Effective implementation of eLearning: a case study of the Australian Army",' *Journal of Workplace Learning*, 17(5/6), pp. 385-397.

Serbessa, D. D. (2006). 'Tension between Traditional and Modern Teaching-Learning Approaches in Ethiopian Primary Schools', 9(1), pp. 123–140.

Spreen, C. A. and Knapczyk, J. J. (2018). 'Measuring Quality Beyond Test Scores: The Impact of Regional Context on Curriculum Implementation (in Northern Uganda)', *FIRE: Forum for International Research in Education*, 4(1). doi: 10.18275/fire201704011110.

Straub,D., Boudreau, M.C., Gefen,D. (2004). Validation guidelines for IS positivist research.Communication of AIS. 13. 380-427.

Suhail, N. A. and Mugisa, E. K. (2007). 'Implementation of E-learning in Higher Education Institutions in Low Bandwidth Environment : A Blended Learning Approach', *Educational Technology*, (Seufert), pp. 302–322.

Sujatha R.and Rao B. (2011). 'taxonomy construction techniques,issues and challenges', *Indian*, 2(5), p. 664.

Suresh, E. S. M. and Kumaravelu, A. (2017). 'The quality of education and its challenges in

developing countries', *2017 ASEE International Forum*.

Suzuki, K. (2009). 'E-Learning in Japan : Past , Present , and Future', *International Conference:Technology and Future Learning Space*, pp. 9–17.

Tarus, J. K., Gichoya, D. and Muumbo, A. (2015). 'Challenges of Implementing E-Learning in Kenya : A Case of Kenyan Public Universities', 16(1), pp. 120–141.

Tomczyk, Ł., Potyrała, K., Włoch, A., Wnęk-Gozdek, J. and Demeshkant, N., (2020). Evaluation of the Functionality of a New E-Learning Platform vs. Previous Experiences in E-Learning and the Self-Assessment of Own Digital Literacy. Sustainability, 12(23), p.10219.

Toprak, Ozkanal, Aydin, and Kaya (2010). 'Ethics in e-learning', *Turkish Online Journal of Educational Technology*, 9(2), pp. 78–86.

UNESCO (2005). *Education for all Global Monitoring Report 2005. UNESCO, Paris, p. 392*.

UNESCO (2012). 'World Data on Education Données mondiales de l ' éducation Datos Mundiales de Educación'.

UNESCO (2014). 'Education Systems in ASEAN+6 Countries: A Comparative Analysis Selected Educational Issues', *Education Policy Research Series*, 5, p. 87. Available at: http://www.right-to-education.org/sites/right-to-education.org/files/resource-attachments/UNESCO_Education_Systems_in_Asia_Comparative_Analysis_2014.pdf%0Ahttp://unesdoc.unesco.org/images/0022/002267/226757e.pdf.

Varghese, N. V. (2011). 'Globalization and cross-border education: Challenges for the development of higher education in Commonwealth countries. Kuala Lumpur: International Institute for Educational Planning (IIEP).'

Wallace, D. (2009). 'Parts of the Whole: Approaching Education as a System', *Numeracy*, 2(2). doi: 10.5038/1936-4660.2.2.9.

Widyanti, A. and Park, J. (2020). 'e-Learning readiness and perceived learning workload among students in an Indonesian university Bandung Institute of Technology (ITB), Indonesia Recommended citation : e-Learning readiness and perceived learning workload among students in an Indonesian', *Knowledge Management And E -Learning*, 12(1), pp. 18–29.

Yin, R.K. (2009). Case Study Research: Design and Methods. Essential guide to qualitative methods in organizational research, (4th ed.). Sage Publications, Thousand Oaks.

Zanamwe, N. (2010). 'Towards a Suitable Framework for Blended Multimedia E-', (August).

Appendices

Appendix A: Sample questionnaire and Interview questions with experts, instructors and administrator

Survey questionnaire for eLearning experts

A generic eLearning framework and a methodology for eLearning adoption

Dear respondents

This survey is conducted for the purpose of evaluating a proposed conceptual generic eLearning framework as well as proposed methodology for eLearning adoption. You are kindly invited to provide your expert opinion to the following questionnaire items by ticking on the correct choice or writing in the space provided for short answer questions.

We hereby assure that the information collected from this questionnaire is confidential and will only be used for academic purpose.

Thank you for taking your precious time to complete this questionnaire.

Section A. Demographic data

It is just to collect personal data of the respondents

1. Gender

- ☐ male
- ☐ female

2. Age group

- ☐ 25-40
- ☐ 41-50
- ☐ above 51

3.Job title *

_____

4. How long have you worked in your current position?

- ☐ below 5 years
- ☐ 5-10 years
- ☐ 11-16years
- ☐ 16 to 21years
- ☐ above 22 years

5. Area of Specialty *

_____

6. Highest level of education *

- ☐ Bachelor
- ☐ Masters
- ☐ PhD and above
- ☐ Other:

Section B. Generic eLearning framework

Our proposed generic eLearning framework consists of a range of building blocks described along the following lines:

• **Institution** building block- It deals with administrative affairs such as policies, IT services, finance and payment services, registration and application facilities. It also deals with academic affairs such as training and incentive for eLearning users, copyright, technology support, information about instructors and students. Furthermore, the institution is about student affairs such as library and bookstore services, financial aid workshop, counselling and orientation services.

• **Pedagogy** building block-It deals with clear course objective, appropriate teaching method, usage of course relevant graphics, accurate course content, mixture of media in the teaching method, online teaching-learning support.

• **Technology** building block-It takes care of issues such as hardware and software requirements, Interface design and technological resource support.

• **Evaluation** building block-It deals with assessment of learning through online exams and quizzes. It also deals with assessment of the overall performance of learning environment.

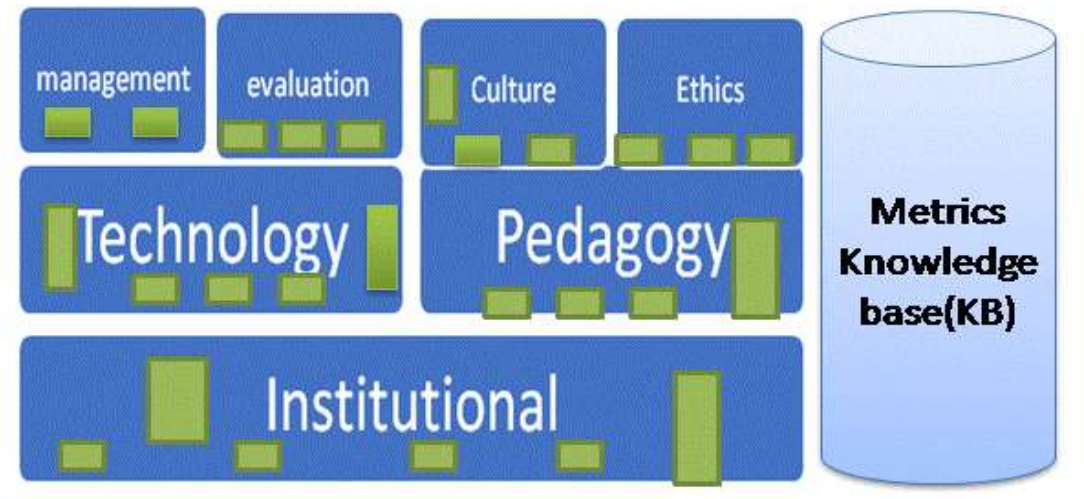
• **Management** building block-It deals with management of information distribution such as schedule, announcements, and students 'grades. It also deals with maintenance of learning environment such as staffing, budgeting, management of course content and learning resources as well as security measures.

• **Culture** building block-It deals with social diversity, economic diversity, political, language and religious diversity.

• **Ethics** building block-It deals with geographical diversity, learner diversity, information accessibility, mutual respect policy, plagiarism and privacy policy

Our proposed framework also has a component referred to as Metrics Knowledge Base that contains guidelines, policies, standards and regulations that can be used as a benchmark for evaluating the existing eLearning framework and for cross-comparison purpose. For example, in the metrics knowledge base, there should be a rule that says above 80% of students must have computer and internet access all the time.

As depicted in the figure 1 of the generic eLearning framework below, the institutional building block is the foundation of the framework and should be taken care of at first. Then the technology and pedagogy building blocks may follow though there is still some back-and-forth movement between or among the three building blocks as necessary. Then the remaining four building blocks namely management, evaluation, culture and ethics are considered as catalysts to improve the performance of the technology, pedagogy and institution building blocks.



Questions

Please provide your answers for the following questions based on the above description of the framework and its components.

7. Do you agree with all the building blocks of generic eLearning framework? *

- ☐ Yes
- ☐ No

8. Do you think that the building blocks in the generic framework are inclusive of all the eLearning issues? *

☐ Yes

☐ No

9. If your answer for question number 8 is No, please suggest a building block/s that you think is important for the implementation of eLearning? *

_____

10. Do you agree with the sequential arrangement of the building blocks? *

☐ Yes/No

11. If your answer is No for question number 10, suggest any other sequential arrangements and write your reason behind the arrangement. *

_____

12. Any Suggestions and comment on the generic eLearning framework *

_____

13. Are you in agreement with the proposed artifacts that make up the generic framework and that it can bring effective implementation of eLearning *

☐ Yes

☐ No

14. Any suggestion to improve the generic eLearning framework? *

_____

SECTION C:A METHODOLOGY FOR ELEARNING ADOPTION

The following are explanations of steps in a methodology for eLearning adoption

Step 1: Assessment: current eLearning practice. Assessing whether the institution started to implement eLearning or not.

Step 2: Identification of existing eLearning building block if eLearning practice is already started. Otherwise, advise the institution to adopt the generic eLearning framework.

Step 3: Maturity assessment: It is just checking whether a building block is in good status or not. For example, is the institution building block in good status or not. Is there necessary training given to instructors and students who will use the system, is there incentive provided to eLearning users and so on. Does the institution building block fulfil above 50% of the evaluation criteria from the metrics knowledge base? If so, we can say it is matured, otherwise it is immature.

Step 4: Gap analysis wrt generic framework: Identification of gaps of the existing eLearning framework as compared to the generic framework will be done in this step. The deliverable of this step is identified gaps or problems of the existing eLearning framework as compared to the generic framework.

Step 5: Implementation and integration of new building blocks: If the existing eLearning systems lack some building blocks of the generic framework and if it is believed that they are necessary, these should be integrated with the existing system.

The diagrammatical representation of a methodology for eLearning adoption is shown below

Figure 2. A Methodology for eLearning adoption

1. Do you agree with all the steps of a methodology for eLearning adoption? *

☐ Yes

☐ No

Other:_____

2. If your answer is No for question number 1, please suggest other steps for a methodology for eLearning adoption. *_____

3. Is there any step that is important but not incorporated in the above methodology? *

_____

4. Any suggestion and comment to improve the proposed methodology for eLearning adoption? *

_____

5. Are you in agreement with the proposed artifacts that make up a methodology for eLearning adoption and that it can bring effective adoption of eLearning? *

- ☐ Yes
- ☐ No

6. If your answer for question number 5 is No, please write your reason. *

_____

Interview questions on assessing current eLearning practice

1. How is your eLearning established and what are the features that it incorporates
2. Does your eLearning system incorporate registration and application facilities (Do registration and application facilities are integrated to the eLearning system)?
3. Is there online counselling facility that may be integrated to the Moodle?
4. Is there a library and bookstore facility integrated with the eLearning system?
5. Does the institution give or arrange necessary trainings for eLearning users (both students and instructors)?
6. Does the institution give funds for eLearning related researches and conferences?
7. Is there eLearning policy or strategy in your institution?
8. Does the institution provide incentives for ecourse developers and also eLearning users in the institution?
9. Does the institution consider copy right issues of the eLearning materials that the instructors are developing?
10. Is there an organized ecourse development process that can generate ecourse appropriate for the eLearning environment?
11. Do you think that the hardware and software requirements of eLearning in your institutions are fulfilled?
12. Is the interface of the eLearning system usable and accessible ?
13. Is there a technical support facility for easy usage of eLearning?
14. Does the eLearning system incorporates facilities that can provide clear announcements and schedules to eLearning users?
15. Do the log in/log out, upload/download facilities well established in the eLearning system?
16. Does the eLearning system consider social diversity among learners as well as instructors?
17. Does the eLearning system consider economic and political diversity among the users of eLearning?

18. Does the eLearning system consider religious and language diversity?
19. Is there equal access of education for all students?
20. Is there ethical rule on discussion through eLearning?
21. Does the eLearning system support all quiz, exam and other evaluations?
22. Does the eLearning system support evaluation of teaching learning environment and course development environment?
23. Please tell me the weakness of your eLearning system

Appendix B: Sample Building blocks, items and item codes of the GeF (From the instructors' questionnaire)

Building block 1: Institution

Codes	Items	Sources
I1	I believe that institutions should be ready in many aspects like giving trainings and giving technical support.	Khan (2005), Elameer Amer Saleem and Idrus Rozhan , 2012,Khan, B.H. 2005, Khan, B.H. 2001, Lee-Post, A. 2009 Zanamwe, N. 2012, Mohamed J., Oso W., 2014,Hagos Y,2019.
I2	I believe the institutions should have eLearning policy to implement eLearning	Mohamed J., Dr. Oso W., 2014, Zanamwe, N. 2012, Khan (2005), Elameer Amer Saleem and Idrus Rozhan , 2012
P4	I believe there should be different appropriate methods for different content and objective in the eLearning system	Bhuasiri et al. (2012); Lee, 2010; Sun et al. (2007); Panda and Mishra (2007), Self-development from empirical data
P5	I believe there should be a mixture of media(audio, video..) that should be used in the eLearning environment	Bhuasiri et al. (2012); Lee, 2010; Sun et al. (2007); Panda and Mishra (2007), Self-development from empirical data
T1	I feel the application software/system should contain different aesthetic/user friendly features	Zanamwe, N. 2012, Khan (2005), Elameer Amer Saleem and Idrus Rozhan , 2012 & Self- development from empirical data
T2	I believe that the software and hardware requirements of eLearning system should be fulfilled.	Zanamwe, N. 2012, Khan (2005), Elameer Amer Saleem and Idrus Rozhan , 2012 & Self- development from empirical data
M2	I believe that the eLearning system should be secured and only accessible for those who are permitted	Zanamwe, N. 2012, Khan (2005), Elameer Amer Saleem and Idrus Rozhan , 2012 & Self- development from empirical data
M3	I believe that there should be ease of uploading and downloading learning materials, assignment and grades in the eLearning system	Zanamwe, N. 2012, Khan (2005), Elameer Amer Saleem and Idrus Rozhan , 2012 & Self- development from empirical data

C1	I believe that the eLearning system should meet the need of students from different economic background	Zanamwe, N. 2012, Khan (2005), Elameer Amer Saleem and Idrus Rozhan , 2012 & Self- development from empirical data
E1	I believe that the eLearning system should support evaluation of students academic achievement	Zanamwe, N. 2012, Khan (2005), Elameer Amer Saleem and Idrus Rozhan , 2012 & Self- development from empirical data
E3	I believe that the eLearning system should support evaluation of learning environment	Zanamwe, N. 2012, Khan (2005), Elameer Amer Saleem and Idrus Rozhan , 2012 &Self- development from empirical data
Et1	I believe that the eLearning system should consider digital gaps of learners and band width difference of learners	Zanamwe, N. 2012, Khan (2005), Elameer Amer Saleem and Idrus Rozhan , 2012 & Self- development from empirical data

*Codes: represents code assigned to each of the items for each building blocks. For example: "I" stands for institution building block and the number attached to it stands for the consecutive item's numbers such as I1 stands for item number 1 representing the first item.

Appendix C: Instructors' Questionnaire on validating GeF

I. Questionnaire on the attitude towards the relevance of the building blocks

Dear Participant: The purpose of this questionnaire is to collect data regarding the attitude of instructors towards the relevance of the building blocks incorporated in the generic framework. To this effect questions related to the institution's effort to start eLearning system, nature of the eLearning courses, facilities needed, cost effectiveness of the program and users/stakeholders satisfaction are presented here after. Please click on one of the options that represent your correct choice.

Consent: The researcher can assure that the information provided on the questionnaire is confidential. The identities or personal details of the respondents will not be disclosed to others, except for research purposes, and any data that will be used in the report will not be linked to any respondents. Respondents can withdraw their participation at any time if they feel any discomfort

SECTION A: DEMOGRAPHICS

1. What is your gender?
    a. Male
    b. female
2. What is your status?
    a. Phd
    b. MSC/MA
    c. BSC/BA

d. Diploma

SECTION B: Attitude questions

Type	code	Questions	Strongly agree	agree	Neutral	disagree	Strongly disagree
Institutional	I1	I believe that institutions should be ready in many aspects like giving training for instructors and students, giving technical support to both students and teachers in eLearning related matters					
	I2	I believe the institutions should have eLearning policy to implement eLearning					
	I3	I believe the institution should manage copy right issues regarding e-content produced.					
	I4	I believe the institution should arrange incentives for teachers so as to participate in the implementation of eLearning					
	I5	I believe the institution should manage server and application software that are used for the eLearning system.					
	I6	I believe the institution should provide online financial aid workshops to assist students with both financial aid forms and other scholarship opportunities					
Pedagogy	P1	I feel there should be a clear alignment among learning goals, activities, assessments, and learner characteristics in the eLearning system					
	P2	I feel there should be a balanced presentation of ideas and appropriate level of detail for a course in the eLearning system					
	P3	I feel there should be number of tools such as email, discussion forum etc. in the eLearning system to facilitate discussion or chat					

	P4	I believe there should be different appropriate methods for different content and objective in the eLearning system					
	P5	I believe there should be a mixture of media(audio, video..) that should be used in the eLearning environment					
technology	T1	I feel the application software/system should contain different aesthetic/user friendly features					
	T2	I believe that the software and hardware requirements of eLearning system should be fulfilled.					
	T3	I feel the application software/eLearning system should contain different aesthetic/user friendly features					
	T4	I believe that the eLearning system should be easily accessible(user friendly interface)					
	T5	I believe that there should be guidance for students on how to set up hardware for video conference, on how to send mail, attach files etc in the eLearning system					
Management	M1	I believe that experienced teachers should be assigned to design courses that they are familiarized with.					
	M2	I believe that the eLearning system should be secured and only accessible for those who are permitted					
culture	C1	I believe that the eLearning system should meet the need of students from different economic, social and political background					
	C2	I believe that the eLearning system should meet the need of students from different language and religious background					
	C3	I believe that usage of icons, jargon, idioms, ambiguous or cute humour, and acronyms that may mean different in different culture should be avoided in the eLearning system					

evaluation	E1	I believe that the eLearning system should support evaluation of students academic achievement					
	E2	I believe that the eLearning system should support evaluation of content development					
	E3	I believe that the eLearning system should support evaluation of learning environment					
ethics	Et1	I believe that the eLearning system should consider digital gaps of learners and band width difference of learners					
	Et2	I believe that geographic diversity of learners should be considered in the eLearning system					
	Et3	I believe that the eLearning system should support mutual respect policy in case of discussions, privacy and plagiarism policy					

II. Questionnaire-structured interviews for ranking building blocks

Our proposed generic eLearning framework consists of a range of building blocks described along the following lines:

Institution building block- It deals with administrative affairs such as policies, IT services, finance and payment services, registration and application facilities. It also deals with academic affairs such as training and incentive for eLearning users, copyright, technology support, information about instructors and students. Furthermore, the institution is about student affairs such as library and bookstore services, financial aid workshop, counselling and orientation services.

• **Pedagogy** building block-It deals with clear course objective, appropriate teaching method, usage of course relevant graphics, accurate course content, mixture of media in the teaching method, online teaching-learning support.

• **Technology** building block-It takes care of issues such as hardware and software requirements, Interface design and technological resource support.

• **Evaluation** building block-It deals with assessment of learning through online exams and quizzes. It also deals with assessment of the overall performance of learning environment.

• **Management** building block-It deals with management of information distribution such as schedule, announcements, and students ‘grades. It also deals with maintenance of

learning environment such as staffing, budgeting, management of course content and learning resources as well as security measures.

• **Culture** building block-It deals with social diversity, economic diversity, political, language and religious diversity.

• **Ethics** building block-It deals with geographical diversity, learner diversity, information accessibility, mutual respect policy, plagiarism and privacy policy.

Please provide your answers for the following questions based on the above description of the framework and its components.

On a scale of 1-6, rank the above mentioned factors (building blocks) that affect implementation of eLearning in order of importance, in the context of WU. In doing so, you will determine the weight of each of the above factors in your institution in the process of implementing eLearning.

	5=Very high importance	4=High importance	3=Medium importance	2=Low important	1=Very low important	0=Not important
Institution						
pedagogy						
management						
ethics						
culture						
technology						
evaluation						

1. List (if any) other factors that you think affect eLearning which have not been included in the above list.
2. Explain the reason why you give the above ranks for each factors

Appendix D: Students' Questionnaire on validating the GeF

Questionnaire on the attitude towards the relevance of the building blocks

Dear Participant: The purpose of this questionnaire is to collect data regarding the attitude of students towards the relevance of the building blocks incorporated in the generic framework. To

this effect questions related to the institution's effort to start eLearning system, nature of the eLearning courses, facilities needed, cost effectiveness of the program and users/stakeholders satisfaction are presented here after. Please click on one of the options that represent your correct choice.

Consent: The researcher can assure that the information provided on the questionnaire is confidential. The identities or personal details of the respondents will not be disclosed to others, except for research purposes, and any data that will be used in the report will not be linked to any respondents. Respondents can withdraw their participation at any time if they feel any discomfort

SECTION A: DEMOGRAPHICS

1. What is your gender?
    a. Male
    b. female
2. What is your educational status?
    a. Phd
    b. MSC/MA
    c. BSC/BA
    d. Diploma
3. Year of study

    a. 2nd
    b. 3rd
    c. 4th and above

SECTION B: Attitude questions

Type	no	Questions	Strongly	agree	neutral	Disagree	Strongly
Institutional	I7	I believe that institutions should be ready in many aspects like giving training for instructors and students, giving technical support to both students and teachers in eLearning matters					
	I8	I believe wireless access in the school and outside school is important for eLearning					

	I9	I believe there should be advising facility through the eLearning system					
	I10	I believe institutes are expected to provide e-mail account and other technical support for students/teachers participating in the eLearning system					
	I11	I believe the institute should provide orientation about procedure of learning, role and responsibilities of teachers and students through the eLearning system					
	I12	I believe students should be provided with book store services through the eLearning system					
	I13	I believe students should be provided with library services through the eLearning system					
	I14	I believe there should be counselling service through the eLearning system					
Pedagogy	P2	I feel there should be a balanced presentation of ideas and appropriate level of detail for a course in the eLearning system					
	P3	I feel there should be number of tools such as email, discussion forum etc.in the eLearning system to facilitate discussion or chat					
	P4	I believe there should be different appropriate methods for different content and objective in the eLearning system					
	P5	I believe there should be a mixture of media(audio, video..) that should be used in the eLearning environment					
Technology	T3	I feel the application software/eLearning system should contain different aesthetic/user friendly features					
	T4	I believe that the eLearning system should be easily accessible(user friendly interface)					
	T5	I believe that there should be guidance for students on how to set up hardware for video conference, on how to send mail, attach files etc in the eLearning system					
Management	M2	I believe that there should be clarity of announcements, schedule and course relevant contact in the eLearning system					

	M3	I believe that there should be ease of uploading and downloading learning materials, assignment and grades in the eLearning system					
	M4	I believe that the eLearning system should be secured and only accessible for those who are permitted					
culture	C1	I believe that the eLearning system should meet the need of students from different economic, social and political background					
	C2	I believe that usage of icons, jargon, idioms, ambiguous or cute humour, and acronyms that may mean different in different culture should be avoided in the eLearning system					
	C3	I believe that the eLearning system should meet the need of students from different language and religious background					
Ethics	Et1	I believe that the eLearning system should consider digital gaps of learners and band width difference of learners					
	Et2	I believe that the eLearning system should support mutual respect policy in case of discussions, privacy and plagiarism policy					
	Et2	I believe that geographic diversity of learners should be considered in the eLearning system					

Appendix D2: Students' Questionnaire on eLearning practice

Questionnaire on how eLearning is practiced in higher institution of Ethiopia

Dear Participant: The purpose of this questionnaire is to collect data regarding the current practice of eLearning in higher institutions of Ethiopia. To this effect questions related to the building blocks(institution, pedagogy, technology, management...) of the generic framework and that can evaluate the current practice of institutions are presented below. Please click on one of the options that represent your correct choice.

Consent: The researcher can assure that the information provided on the questionnaire is confidential. The identities or personal details of the respondents will not be disclosed to others,

except for research purposes, and any data that will be used in the report will not be linked to any respondents. Respondents can withdraw their participation at any time if they feel any discomfort

SECTION A: DEMOGRAPHICS

1. What is your gender?
    a. Male
    b. female
2. What is your educational status?
    a. Phd
    b. MSC/MA
    c. BSC/BA
    d. Diploma
3. Year of study
    a. 2nd
    b. 3rd
    c. 4th and above
4. Which college do you belong to?
    a. Technology
    b. Health
    c. Social science
    d. Natural science
    e. Others
5. Which university do you belong to?
    a. Jimma(JU)
    b. Arba Minch(AMU)
    c. Adama science and technology
    d. Others

Students' Questionnaire

Type	no	Questions	Always	Very frequently	sometimes	rarely	never
ic questions	G1	Students, in our University, make use of electronic Learning (eLearning) software in order to support their education.					
	G2	Students, in our University, make use of social media (like face book) in order to support their education.					

	G3	Students, in our University, make use of chat/discussion forum through an eLearning system in order to support their education.					
	G4	Teachers, in our University, are providing study material to students through an eLearning system (software).					
	G5	Teachers, in our University, are providing study material to students through the CDs(secondary storage devices)					
	G6	Teachers, in our University, are organizing group assignment for students through the eLearning system.					
	G7	In our university, education related news is reaching to student through the eLearning application (software).					
	G8	Students, in our University, are interacting with peer teachers through the eLearning application (software).					
	G9	In our university, education related news is reaching to student through the eLearning application (software).					
tution			sa	a	N e u	D	sd
	I1	The University provides e-mail accounts for eLearning users in order to use the eLearning application (software).					
	I2	The University provides technical support (support on downloading, uploading, and use of teleconference) for eLearning users while using the eLearning application(software)					
	I3	The University provides orientation about procedure of learning through an eLearning system.					
gogy	P1	There is a balanced presentation of ideas, and appropriate level of detail in the course provided by our eLearning application(software)					
	P2	In our university, each unit of the ecourse builds on the previous unit and it shows sense of continuity of courses					
nology	Tec1	The application (the eLearning system),in our University, contains different artistic(attractive)features that help students perform their tasks					
	Tec2	There is clarity of instruction in the application(in the eLearning system) of our University					
	Tec3	There is description of what the student should do in each step of learning, in the eLearning application of our University.					

	Tec4	The application (eLearning system) of our University takes less time to complete a task.					
	Tec5	Users encounter errors less frequently when using the application (eLearning system) of our University.					
	Tec6	There is guidance on how to set up hardware for video conference in our eLearning application.					
	Tec7	There is guidance on how to send mail, attach files in our eLearning application.					
Management	Mg1	There is clarity of announcements, schedule and course relevant contact in our eLearning application.					
	Mg2	There is a means to submit students' assignment, quizzes in our eLearning application.					
	Mg3	Students can easily access grades through the eLearning application					
	Mg4	There is a means for the students to log in to the system (eLearning application) easily.					
culture	Cu1	A teacher in our eLearning application approach students' friendly or achievement conscious according to their culture.					
	Cu2	The eLearning application, in our University, able to treat students from different culture equally; whether they are achievement conscious or relaxed.					
	Cu3	Economic diversity among learners is considered while preparing and offering course through our eLearning application.					
	CU4	Political diversity among learners is considered while preparing and offering course through our eLearning					
	CU5	In our eLearning application, there is no usage of jargon, idioms, ambiguous or cute humour, and acronyms that don't					
	CU6	In our eLearning application, there is no usage of navigational icons or images whose meaning is different in different culture					
	CU7	There is effective communication between learners and others through the eLearning application.					
uation	Ev1	There is a means, in our eLearning application, to measure the performance of learners after taking the e-course.					

	Ev2	There is a means, in our eLearning application, to measure the satisfaction of learners in learning the e-course.					
	Et1	Geographical diversity that leads to, for example, different time zone among learners is considered by our eLearning application.					
	Et2	The course, in our eLearning application, is designed to support learners who adapt individualized, distributed learning environment					
	Et3	In our eLearning application, there are diverse learning styles for diverse learners.					
	Et4	In our eLearning application, there is equal accessibility of information by different learners.					
	Et5	In our eLearning application, there is a consideration of digital gaps (gaps in computer skill) among learners. So that the gaps can easily be filled.					
	Et6	In our eLearning application, there is a rule for mutual respect among learner in discussion group					
	Et7	In our eLearning application, there is a rule for learners on how to behave and post messages in online discussions so that their postings do not hurt others' feelings.					

Appendix E: Instructors' Questionnaire on eLearning practice

Questionnaire on how eLearning is practiced in higher institution of Ethiopia

Dear Participant: The purpose of this questionnaire is to collect data regarding the current practice of eLearning in higher institutions of Ethiopia. To this effect questions related to the building blocks(institution, pedagogy, technology, management...) of the generic framework and that can evaluate the current practice of institutions are presented below. Please click on one of the options that represent your correct choice.

Consent: The researcher can assure that the information provided on the questionnaire is confidential. The identities or personal details of the respondents will not be disclosed to others, except for research purposes, and any data that will be used in the report will not be linked to any respondents. Respondents can withdraw their participation at any time if they feel any discomfort

SECTION A: DEMOGRAPHICS

1. What is your gender?
    a. Male
    b. female
2. What is your educational status?
    a. Phd
    b. MSC/MA
    c. BSC/BA
    d. Diploma
3. Which college do you belong to?
    a. Technology
    b. Health
    c. Social science
    d. Natural science
    e. Others
4. Which university do you belong to?
    a. Jimma(JU)
    b. Arba Minch(AMU)
    c. Adama science and technology
    d. Others

Section B: Attitude questions

Type	no	Questions	SA	A	N	D	SD
institution	I1	There is institutional strategy on eLearning in our University.					
	I2	Teachers, in our University, translate eLearning strategies into actionable goals that help them drive their day-to-day work.					
	I3	In our university, faculty members are provided with the necessary skills and knowledge to participate in the implementation of eLearning.					
	I4	In our university, there is incentive for the teacher who participates in the development of e-courses					
	I5	Copy right issues such as about the e-content produced are considered in our University					
	I6	In our university, there is a financial support for faculty to conduct research, attend conferences					

		and present papers in professional meetings regarding eLearning.					
	I7	Our university have a way of managing application software(eLearning system) and servers for e-courses(for example security to store notes or resources)					
	I8	Our university/institute provides e-mail accounts, disk space for Web pages, and technical support for eLearning users.					
	I9	Our University provides orientation about procedure of learning through the web sites/eLearning system.					
Pedagogy	P1	There is a balanced presentation of ideas, and appropriate level of detail in the course provided by our eLearning application					
	P2	The pedagogical philosophy behind our eLearning application allows instructor to be facilitator (student-cantered approach)					
	P3	The pedagogical philosophy behind our eLearning application allows instructor to be main actor.					
	P4	There is continuity of the courses offered in our eLearning application.					
	P5	There is a clear alignment among learning goals, activities, assessments, and learner characteristics, in the course provided by our eLearning application.					
Technology	T2	In our university/ institutes, the software requirements of the eLearning application are fulfilled					
	T3	The application (the eLearning system), in our University, contains different aesthetic (attractive/friendly) features that help students perform their tasks.					
	T4	The application (eLearning system) of our University takes less time to complete a task.					
	T5	There is guidance on how to send mail, attach files in our eLearning application					

	T6	Users encounter errors less frequently when using the application (eLearning system) of our University.					
	M1	There is a means, in the eLearning application, to upload teaching materials for students.					
	M2	In our university, appropriate teachers are assigned to prepare the right course.					
	M3	In our eLearning application, there is uploading of course contents to the appropriate users (secured information access).					
culture	C1	The eLearning application, in our University, able to treat students from different culture equally; whether they are achievement conscious or relaxed.					
	C2	In our university, economic diversity among learners is considered while preparing and offering course through the eLearning application.					
	C3	In our university, political diversity among learners is considered while preparing and offering course through the eLearning application.					
	C4	In our eLearning application, there is no usage of jargon, idioms, ambiguous or cute humour, and acronyms that don't have the same meaning in different culture.					
	C5	In our eLearning application, there is no usage of navigational icons or images whose meaning is different in different culture. For example, right arrow for the next page may mean different in different culture					
evaluation	E1	There is a means to measure the cost-effectiveness of the eLearning program in our University.					
	E2	There is a means, in our eLearning application, to measure the satisfaction of teachers towards the eLearning application					

	E3	In our university, there is a means to measure the effectiveness of the e-content development process.					
	E4	In our university, there is a means to measure Individuals' skills, who are involved in e-content development.					
Ethics	Et1	Geographical diversity among learners is treated by our eLearning application.					
	Et2	In our eLearning application, synchronous communications are scheduled at reasonable times for all time zones of learners					
	Et3	The course in our eLearning application is designed to support learners who adapt individualized distributed learning environment					
	Et4	In our eLearning application, there are diverse teaching styles for diverse learners					
	Et5	In our eLearning application, there is a consideration of digital gaps among learners					
	Et6	In our eLearning application, there are policies, guidelines that prevent plagiarism					

Appendix F: Observation checklist

1. Are there well established computer labs?
2. Are there assigned persons to facilitate eLearning?
3. Are the learning management systems well constructed?
4. **eLearning practice Observation checklist**

Based on the observation of the institution's performance, the following table will be filled using the scales below.

Weights ------ 5=Very high importance(VHI),4=high importance(HI),3=medium importance(MI),2=Low importance(LI),1=Very low importance(VLI),0=Not important(NI)

Score factor ------ 5=Exceedingly satisfy (ES), 4=substantially satisfy (SS), 3=partially satisfy (PS), 2=satisfy (S), 1=weakly satisfy (WS), 0=doesn't satisfy (DS)

Appendix G: document checklist

1. Is there an eLearning policy?
2. Is there computer and eLearning training schedules?
3. Is there eLearning training manuals or guidelines?
4. Is there eLearning reports/minutes?

Building block	component	elements	Weight of the elements						Score factor of elements					
			5=VHI	4=HI	3=MI	2=LI	1=VLI	0=NI	5=ES	4=SS	3=PS	2=S	1=WS	0=DS
Institutional	Administration	Admissions												
		finances												
		payments												
		IT services												
		policies												
	academic affairs	faculty and staff support												
		instructional affairs												
		Academic Computing Services												
	student services	orientation												
		Bookstore												
		Library Support												

Appendix H:Sample consent letter

The University of South Africa
Regional Learning Center
Addis Ababa

Dear Director

Arba Minch University is one of the First Generation University in Ethiopia with its mission to provide quality education, conduct demand driven research and relevant community services. To achieve these missions, ICT is considered as one and main relevant enabler. Hence, the university has built its own multipurpose ICT infrastructure to implement the required ICT services like eLearning. The university, as the front liner in ICT in the county, has more than six years of experience in using eLearning.

Here then, you requested us to show our consent for your student to collect the data on eLearning for her Doctoral thesis research purpose on January 30, 2017 with your reference number UNISA-ET/KA/ST/29/30-01-17. In response to this letter, we are willing to provide noncritical data for the said purpose; therefore, she is welcome to demand her need at any time in this academic year.

Regards,

FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

Appendix I: Ethical certificate

UNISA university of south africa

UNISA COLLEGE OF SCIENCE, ENGINEERING AND TECHNOLOGY'S (CSET) RESEARCH AND ETHICS COMMITTEE

29 June 2017

Ref #: 005/ZAA/2017/CSET_SOC
Name: Zebiba Ali Abegaz
Student #: 55781837

Dear Mrs Zebiba Ali Abegaz

Decision: Ethics Approval for three years (Humans involved)

RECEIVED
2017 -07- 04
OFFICE OF THE EXECUTIVE DEAN
College of Science, Engineering and Technology

Researcher: Zebiba Ali Abegaz
P.O. Box 9840, Addis Abeba
alizebiba@gmail.com, +25 503 311 2650

Supervisor (s): Prof EK Ngassam
eketcha@gmail.com, +27 82 355 2519

Proposal: Taxonomy of eLearning

Qualification: PhD in Information Systems

Thank you for the application for research ethics clearance by the Unisa College of Science, Engineering and Technology's (CSET) Research and Ethics Committee for the above mentioned research. Ethics approval is granted for a period of three years from 29 June 2017 to 29 June 2020.

1. The researcher will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study, as well as changes in the methodology, should be communicated in writing to the Unisa College of Science, Engineering and Technology's (CSET) Research and Ethics Committee. An amended application could

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

be requested if there are substantial changes from the existing proposal, especially if those changes affect any of the study-related risks for the research participants.

3. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study.
4. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data require additional ethics clearance.

Note:

The reference number 005/ZAA/2017/CSET_SOC should be clearly indicated on all forms of communication with the intended research participants, as well as with the Unisa College of Science, Engineering and Technology's (CSET) Research and Ethics Committee

Yours sincerely

Adde da Veiga

Dr. A Da Veiga

Chair: Ethics Sub-Committee School of Computing, CSET

Prof I. Osunmakinde

Director: School of Computing, CSET

Prof B. Mamba

Executive Dean: College of Science, Engineering and Technology (CSET)

Approved - decision template – updated Aug 2016

University of South Africa
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Appendix J: Editing certificate

KATHLEEN WOOD & ASSOCIATES

TO WHOM IT MAY CONCERN

This is to certify the I have edited the Doctoral thesis

A Taxonomy of eLearning Frameworks

submitted by

Zebiba Ali Abegaz

Student Number: **55781837**

Signed _____ Date: 9/17/2021

Kathleen Wood (ID no 4603190074083)

Academic Language Editor

KATHLEEN WOOD & ASSOCIATES

Appendix k: Originality Report

Document Viewer

Turnitin Originality Report

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Submitted to Bentley College on 2018-10-15

<1% match ()
Stoltenkamp, Juliet. "An integrated approach to e-learning implementation in a complex higher education setting: a case study of the University of the Western Cape", University of Western Cape, 2012

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Abatihun Alehegn Sewagegn. "Student empowerment through instructors' assessment practices at a university in Ethiopia", 2016

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Masilo, Kgomotso Hilda. "The role of debt counselling in the financial well-being of consumers in Gauteng", 2014