

**TOWARDS A SUITABLE FRAMEWORK FOR BLENDED MULTIMEDIA E-
LEARNING APPLICATIONS**



BY

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A thesis submitted in partial fulfilment of the requirements for degree of Master of
Science in Computer Science.

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August 2010

ABSTRACT

Most universities in developing countries are using a teaching and learning approach known as blended e-learning, however, there was no a framework for blended multimedia-based e-learning applications. Further, there is no knowledge of the impact that blended multimedia-based e-learning has on learning outcomes and satisfaction of learners' needs. This research used two undergraduate courses in the Computer Science Department at the University of Zimbabwe wherein, one posed as a control group and the other as an experimental group. These groups were taught using the blended multimedia-based e-learning approach and blended text-based e-learning approach respectively. Questionnaires were designed and administered to students and instructors to collect information about the level of satisfaction and the optimal mix of tools that go into blended multimedia-based e-learning. Further, students' examination marks for the above mentioned courses were collected and used as a measure of learning outcomes. The collected information was analysed using SPSS. It was found that blended multimedia-based e-learning improves both learning out comes and the level of satisfaction of learners needs. In addition, it was also found out that the optimal mix of tools in blended learning is 55 per cent against 45 per cent in favour of the traditional face-to-face approach. Lastly, a framework for blended multimedia e-learning was developed.

DEDICATION

This dissertation is dedicated to my wife, Lilenciya M and my daughter Listanciya E.

DECLARATION

I, Ngonidzashe Zanamwe, do declare that this dissertation is the result of my own investigation and research, except to the extent indicated in the acknowledgements, references and by comments included in the body of the report, and that has not been submitted in part or full for any other degree to any other university or college.

Student signature

date

ACKNOWLEDGEMENTS

I would like to extend my thanks to my supervisor Mr. T. Rupere, who gave me an opportunity to work with him and explore the field of blended multimedia e-learning. I started my work in the field of blended multimedia learning under his guidance. Thanks for all the encouragement, guidance, help and support.

I wish to specifically thank my wife, family and friends for unwavering support and understanding during the many hours I dedicated to achieving this milestone in my life and career.

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CHAPTER ONE

1. Introduction

1.1. Background

This research seeks to develop a suitable framework for blended multimedia e-learning applications. Moore and Bryant (1989) established that, the history of blended e-learning dates back to more than 15 years. However, currently there is no a suitable framework for blended multimedia e-learning that takes into account the learning needs of learners in developing countries. The University of Zimbabwe is currently using a text-based e-learning platform known as Claroline.

Claroline is a collaborative e-learning and e-working platform. Also, it is open source software that allows many organizations worldwide such as universities, schools and companies to create and administer courses and collaboration spaces through the web. In addition, Claroline is used in more than 80 countries and is available in more than 30 languages. To this end, it is evident that the University of Zimbabwe needs a multimedia-based e-learning system to exploit advancements in multimedia technology and also have in place an e-learning platform that caters for the learning needs of the visually impaired.

The need for this kind of research is further justified by a quotation from Koper (2003) who averred that, “there is lack of integration and harmonization in the e-learning field and even very basic theories and models about e-learning are missing”. The University of Zimbabwe is one such institution where there is lack of blending in the e-learning field. A review of literature shows that there is no a suitable e-learning framework for institutions in developing countries such as the University of Zimbabwe which is the major thrust of this research. Existing frameworks are general and not weighted hence are not suitable for institutions in developing countries.

When it comes to the definition of blended learning, it is worth noting that there is no a universally accepted definition of the phrase, however, Heinze Aleksej (2008) suggested that a better term for blended learning is blended e-learning. The term blended e-learning is often used interchangeably with the term blended learning which refers to the mix of traditional instructor-led training, synchronous online conferencing or training and asynchronous self-paced study (Singh, 2003). Blended multimedia-based e-learning frameworks being used in institutions in developed countries cannot be transferred to institutions in developing countries because of differences in educational settings in developing and developed countries (Chimombo 2005, 131). Hence, there is a knowledge gap which this research seeks to address.

It must be noted that there are already many e-learning programs offered in developing countries which were developed by various national and international initiatives. Some of these programmes are Aptech and World Links for Development Program (Hawkins, 2002). Most such programmes were implemented through international institutions or operate cross-nationally but they note that during the transfer of such programs, country specific differences and differences between learners, notably, learner backgrounds and language should be taken into account since these can be barriers to achieving the objectives of e-learning programs.

From the foregoing, it is evident that either the adaptation of the learning resources or general customization of the entire e-learning system should be considered if e-learning systems are to be transferred from developed to developing countries. To support the above point of reusing existing technologies and contents in different contexts, Richter and Pawlowski (2007, 4528) noted that various kinds of customizations have to be

considered when transferring e-learning systems from developed to developing countries at institutional level. Further to that, Brusilovski (2001, 96) established that, specific needs of users have to be identified to supply adequate adaptation of learning resources.

Chimombo (2005, 131) indicated that educational settings in developing countries are different from settings in developed countries and that these countries are characterised by low quality of education and narrow possibilities in attending schools in rural areas because of far distances and high opportunity costs. Concerning the foregoing issue, Kohn *et al.* (2008) argued that, barriers resulting of no or little customization of e-learning systems can be of cultural character, technological character, and are due to differences in previous knowledge.

1.2. Statement of the Problem

First World countries such as the United States of America, the United Kingdom, Canada just to mention a few have frameworks for blended multimedia e-learning applications. These frameworks were designed with learning needs of students in those (developed) countries in mind yet there is no a suitable framework for blended multimedia e-learning applications for institutions in developing countries such as the University of Zimbabwe. Although, the University of Zimbabwe uses the blended text-based learning approach, there is no a suitable mix of learning methods that best suits the needs of learners at UZ. Instructors are using varying mixes of the blended text-based e-learning approach. In addition to the foregoing, this approach uses a text-based e-learning platform as opposed to a multimedia based system which is believed to bring more satisfaction to learning needs. Lastly, there is no a body of knowledge on the impact that the blended multimedia e-learning approach has on the learning outcomes of learners from institutions in

developing countries, UZ in particular. There is also absence of information regarding whether the use of the blended multimedia-based e-learning approach can bring maximum satisfaction to students' academic needs.

Further to that, the existing text-based e-learning system does not allow learners to access learning objects in various forms such as audio or video. This is believed to negatively impact on learning outcomes since voice and body language of the trainer is not captured which is strongly thought to have a positive effect on the learning outcomes. In light of the above deliberations, it clear that there is need to develop a suitable blended e-learning framework for Zimbabwe and the University of Zimbabwe in particular.

1.3. Research Aim

The ultimate goal of the study is to develop a suitable framework for blended multimedia e-learning applications that suits the learning needs of learners in developing countries, in particular needs of learners at the University of Zimbabwe. Further, the research aims to design and develop a blended multimedia based e-learning system that will fit well in the current and future systems.

1.4. Research Objectives

The objectives of the study are:

- 1.4.1. To establish the impact of the blended multimedia-based e-learning approach on learning outcomes of students at universities in developing countries notably the University of Zimbabwe.

- 1.4.2. To determine whether the use of the blended multimedia-based e-learning approach can bring maximum satisfaction to academic needs of students at universities in developing countries notably the University of Zimbabwe.
- 1.4.3. To establish how best multimedia e-learning elements can be blended to come up with the best mix that suits learning needs of learners at universities in developing countries notably the University of Zimbabwe.
- 1.4.4. To develop a blended multimedia e-learning framework suitable for the University of Zimbabwe.

1.5. Research Questions

The research questions of the study are:

- 1.5.1. What is the impact of the blended multimedia-based e-learning approach on learning outcomes of students at universities in developing countries notably the University of Zimbabwe?
- 1.5.2. Does the use of the blended multimedia-based e-learning approach bring maximum satisfaction to academic needs of students at universities in developing countries notably the University of Zimbabwe?
- 1.5.3. How are multimedia based e-learning elements blended to come up with the best mix that suits learning needs of learners at universities in developing countries notably the University of Zimbabwe?
- 1.5.4. What is the most suitable framework for blended multimedia e-learning for the University of Zimbabwe?

1.6. Research Hypothesis

- 1.6.1. Null hypothesis (H_0): There is no difference between the learning outcomes produced by the blended multimedia based e-learning approach and blended text-based e-learning approach.
- 1.6.2. Alternative hypothesis (H_1): The blended multimedia based e-learning approach produces superior learning outcomes to those of the blended text-based e-learning approach.
- 1.6.3. Null hypothesis (H_0): There is no difference in the levels of satisfaction of learners' needs brought about by the blended multimedia-based e-learning approach and blended text-based e-learning approach.
- 1.6.4. Alternative hypothesis (H_1): The blended multimedia based e-learning approach brings more satisfaction to learners needs than the blended text-based e-learning approach.

1.7. Software and Hardware Requirements

Claroline is the major software requirement for this research. Claroline is a collaborative e-learning and e-working platform (Learning Management System) released under Open Source license (GPL). It allows hundreds of organizations worldwide (universities, schools, companies, associations,) to create and administer courses and collaboration spaces through the web.

Apart from that, other software requirements come in the form of prerequisite software. These are third party software components and tools needed to run the Claroline Software. These include Microsoft Windows XP, Vista or 7. In addition, PHP software, Apache Web Server and relational database MYSQL are also required and these bundled

together give WampServer. Podcasting software such as Active Web Cam is also required. This software is used to live stream podcasts from a Webcam to a website. Hardware requirements include computers with speakers, cameras and microphones.

Also, a powerful server is required. The server must have at least 4 gigabytes of RAM and the clock speed must be at least 3.0 gigahertz. The server must also have a hard disk which is big. The actual size always depends on the number of courses being offered but at least 15 gigabytes must be reserved for each course.

1.8. Justification

This study is justified by the need for a better understanding of both the practice of blended learning and its pedagogical foundations and by the current lack of a generally applicable conceptual framework for blended e-learning in institutions in developing countries such as the University of Zimbabwe. Also, the research is justified by the need to develop and use a multimedia based e-learning and coming up with an optimal mix of tools that go into the blended multimedia-based e-learning approach. Lastly, this research is necessary since it will establish the impact that the blended multimedia e-learning approach has on learning outcomes of students and the level of satisfaction of needs of learners at the University of Zimbabwe.

1.9. Conclusion

This chapter gave a brief background of the problem, presented the problem statement, outlined the research aim and objectives, listed the research hypotheses, specified software and hardware requirements, presented the research approach and concluded by giving a justification of the study. The next sections of this paper are organised as

follows, chapter two presents the relevant literature, chapter three explains the research methodology, chapter four presents, interprets and discusses research findings and chapter five concludes the research by presenting the research conclusions and recommendations.

1.10. Acronyms

BEL – Blended E-learning

BLE - Blended Learning Environment

BMBEL - Blended Multimedia-Based E-Learning

BMBELA – Blended Multimedia-Based E-Learning Applications

BMBELF - Blended Multimedia-Based E-Learning Framework

CAA – Computer Aided Assessment

CD-ROM – Compact Disc Read Only Memory

DVD – Digital Video Disc

ELS – E-Learning System

EVS – Electronic Voting System

FTF – Face-to-Face

GPL – General Public Licence

IVT - Interactive Video Teleconferencing

LMS – Learning Management System

PBL – Problem Based Learning

PDF – Portable Document Format

SMS – Short Messages

SPSS – Statistical Package for Social Sciences

UZ – University of Zimbabwe

VLE – Virtual Learning Environment

WEA - Workers Education Association

WWW - World Wide Web

CHAPTER TWO

2. Literature Review

2.1. Introduction

This chapter presents literature relevant to this study. More specifically, the chapter begins by giving an overview of e-learning. After that, the chapter will focus on blended e-learning frameworks that were developed and implemented elsewhere. Further to that, the chapter dwells on the impact of the blended multimedia-based e-learning approach on learning outcomes and satisfaction of learners' needs. Lastly, the literature will explore the various mixes of learning methods adopted by various institutions and will dwell on experiences by both developing and developed countries in the use of blended e-learning.

2.2. E-Learning

Itmazi and Tmeizeh (2008) claimed that e-learning became a hot topic in the 1990's after the spread of the Internet. Furthermore, they averred that, although e-learning has a relative short history, it is becoming an important part of learning. The majority of the universities adopted some kinds of e-learning within their learning systems. They defined e-learning as any learning that could be realized in a computer connected generally with an Internet or Intranet network.

2.2.1. E-learning Models

Itmazi and Tmeizeh (2008) maintained that there are two models of e-learning namely, the synchronous e-learning model and the asynchronous e-learning model. They postulated that, synchronous models imply that all learners and instructors log on at the same time and communicate directly and virtually with each other. All the learners must be in the classroom at a certain time for the class to begin. Itmazi and Tmeizeh (2008) further asserted that synchronous actions include live web-casts, chat rooms, application sharing, and whiteboard sessions. On the other hand, asynchronous e-learning models

imply that communication between participants does not occur simultaneously. In this case, courseware is served from a web server and delivered on demand to the learner's workstation hence this form of learning is self-paced. With this model, that courseware is normally available to learners anytime. Asynchronous e-learning involves taking a self-paced course, posting messages to a discussion group. Itmazi and Tmeizeh (2008) also claimed that asynchronous e-learning is sometimes referred to as "distributed learning" and it receives more attention because of its lower cost of development, reusable components, and convenience to the learner.

2.2.2. E-learning Approaches

Itmazi and Tmeizeh (2008) asserted that there are three types of e-learning approaches. The first approach is called the enhanced approach. With this approach, e-learning solutions are used to support, facilitate and enhance the traditional learning by using web-based technology, for example course management systems. In addition to the foregoing, Kaminskaya (2006) argued that, even if this approach can reduce some academic seat time (traditional), the reduction must not exceed 24 per cent. Itmazi and Tmeizeh (2008) also indicate that, the majority of the offered e-courses in Traditional Palestine Universities are of this kind.

The second approach to e-learning is called the blended approach. This approach combines traditional face-to-face and online learning, as a result, a big chunk of courseware is delivered online and this approach reduces 25 per cent to 74 per cent of traditional face-to-face meetings (Itmazi and Tmeizeh, 2008). The last approach is online approach which uses the virtual learning (VL). This is achieved without any need to meet

physically, however, this approach could have some face-to-face meeting, for example for examinations, but at least 75 per cent of the courseware is delivered online.

2.2.3. Evolution of Blended E-learning

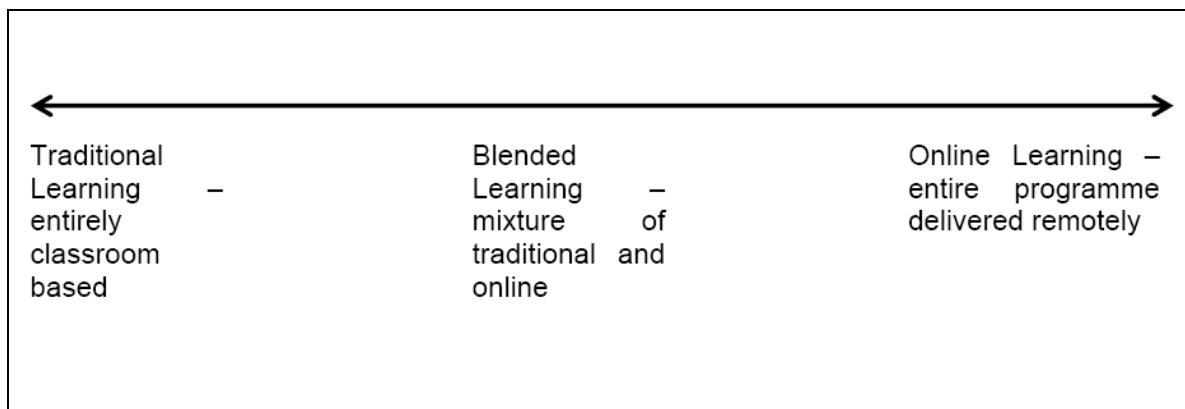
Despite the many unknowns, blended learning estimates continue to rise. More supporting evidence was presented by Kim, Bonk, and Zeng (2005). They reported that, by the end of the decade, it is conceivable that 80-90 percent of college and corporate training classes will be blended and that more than one billion learners around the globe will advance their skills in this fashion. Eddie Gulc, (2006) argued that the term blended learning was attributed in the 1980s to the Open University's model of blending distance learning with face to face support. They did, however, point out that the term is now rather ill-defined and that it can mean different things to different people or institutions or organisations.

Balance Learning (2004) reported that, a 2004 survey in T and D Magazine estimated that the use of blended learning in all of training in the United States in 2005 would double from 2004 and would reach 30 per cent. In line with the above, Rossett and Frazee (2006), averred that, some companies are embracing blended learning as a training method that links learning and performance. There are also expectations that blended learning can create more engaging learning environments (van Dam and Andrade, 2005) and help improve business performances (Harris, 2005).

As is illustrated in Fig 2-1 overleaf, the traditional learning style requires massive investment in buildings and classrooms but does offer the learner face-to-face contact and support. At the other end of the spectrum we find online learning, which can be delivered

anywhere, anytime (asynchronously), for example at the learner's home or workplace, and offered at a time to suit them. Although the latter may be perceived to be less expensive for the provider of the online programme, learners may feel isolated and this may affect motivation and student retention. Blended learning offers some of the best of both worlds: face-to-face tutor support and contact with peers alongside the ability to work remotely, for example be sent and submit work electronically.

Figure 2-1 Educational Experience in Blended Learning Mix



A review of literature on blended e-learning shows that there is no consensus on the when the term blended e-learning was coined as evidenced in the discussion below. Sharpe *et al.* (2006:18) established that the term blended e-learning has been in use for almost twenty years now and “has been constantly changing during this period”. On the other hand, Sharpe *et al* (2006) observed that the term blended learning has been in use for more than fifteen years but that its meaning has been constantly changing during this period. It is evident that both groups of writers did their research in 2006 but, they are disagreeing on when the term was coined. In general, it can thus be said that the term has been in use for the past two decades.

Further supporting evidence is given by Moore and Bryant (1989) cited in Sharpe *et al* (2006). They averred that, in the late 1980s the Workers Education Association (WEA), Ruskin College and the Open University collaborated on what was called a blended learning programme for adults, without qualifications, returning to education. They further indicated that the blended learning programme commingled evening or weekend courses with residential learning sessions and distance learning support. During this era, at Open University the term blended learning was used to signify blend of distance and face-to-face learning. Again, during this period, summer schools and monthly tutorial-group meetings were typical face-to-face interventions in a predominantly distance learning mix (Sharpe *et al*, 2006). Further, they noted that, through the 1990s the corporate training world spoke of blended learning as enhancements to the typical corporate training intervention: the short course.

Sharpe *et al* (2006) reported that in the 1990s, blended learning was characterised by a blend of short courses with pre-course readings and post course activities such as action-learning sets and project-based learning teams to embed the learning in the workplace. They further indicated that short course learners were also given electronic materials for example spreadsheet-based project finance models, trading simulations, technical process modelling and so on. The storage media used then was portable and initially included floppy disk and later compact disk and eventually through web services. In addition to the foregoing, they also established that, at the turn of the century, web-based distance learning and training was being blended back with additional printed manuals and optional face-to-face seminars at locations close to learners.

2.2.4. Definitions of Blended E-learning

It is worth noting that there is no a universally agreed upon definition of the phrase as evidenced by Sharpe *et al.* (2006) who argued that the term blended e-learning has no a universally accepted definition. In support of the foregoing statement, Driscoll (2002: 1) claimed that, the term means different things to different people and its meaning varies in different countries and cultures. Below are some definitions of blended e-learning which the researcher came across while reviewing literature, however it must be noted that the list of definitions presented in this paper is not exhaustive.

While Valathian (2002) described blended learning as "a solution, which includes face-to-face, live e-learning and self paced learning", Gary Motteram and Pete Sharma (2009) maintained that in the corporate world, the term blended e-learning is used to refer to professional development designed to allow workers to remain productively at work and to simultaneously take a training course, delivered through a fusion of self-study manuals, videos and more recently, web-based delivery.

In an attempt to define the same term Gary Motteram and Pete Sharma (2009) established that:

Blended learning is on the cusp of transforming higher education. Blended learning is used here to describe an approach to the design of a course or program that integrates the best of face-to-face and online learning while significantly reducing traditional class contact hours. With the pressing need to address the quality of the learning experience in higher education, blended learning is attracting considerable attention to enable the integration of appropriate and meaningful online experiences.

Still on definitions, Oliver and Trigwell (2005) gave three meanings for the term blended e-learning. In the first one, blended learning is defined as the integrated combination of traditional learning with web-based online approaches. The second one defines phrase as the combination of media and tools employed in an e-learning environment. The last definition views blended learning as the combination of a number of pedagogic approaches, irrespective of learning technology use. However, Al-Huwail, Al-Sharhan and Al-Hunaiyyan (2007) defined blended e-learning as an approach that merges aspects of e-learning such as: web-based instruction, streaming video, audio, synchronous and asynchronous communication, and so on; with traditional "face-to-face" learning.

Another definition was presented by Sharpe *et al* (2006) who claimed that blended e-learning is a synthesis of eight dimensions that embrace the possibilities of blended e-learning. The dimensions are as follows:

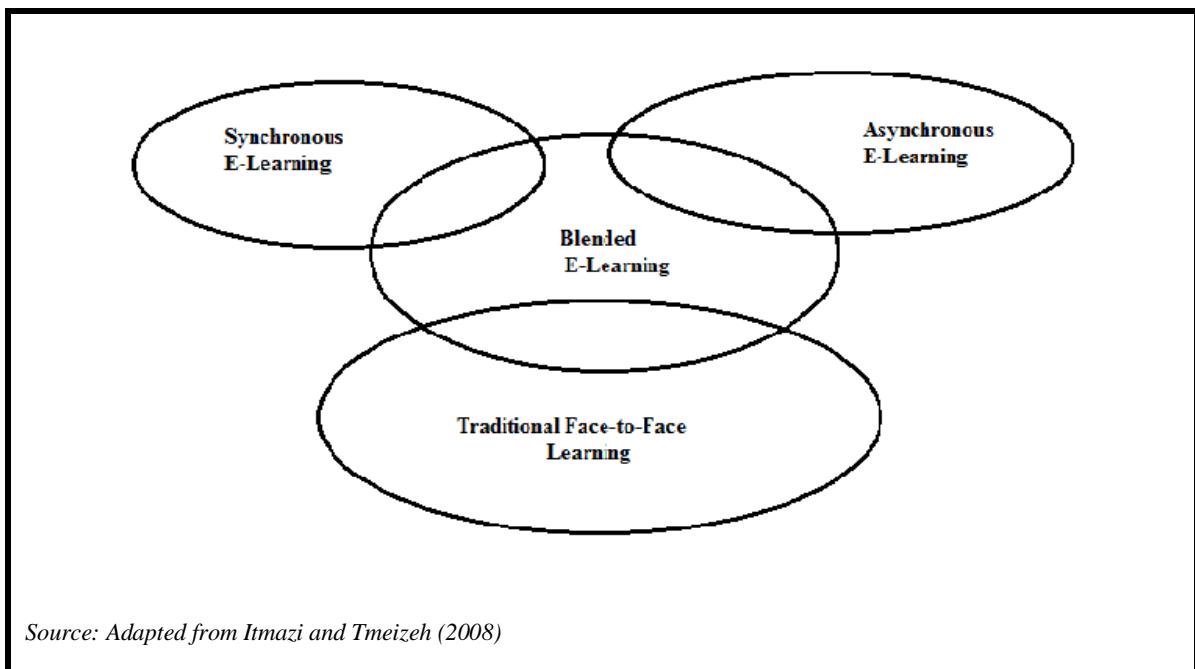
- i. Delivery - different modes (face-to-face and distance education)
- ii. Technology - mixtures of (web based) technologies
- iii. Chronology - synchronous and a-synchronous interventions
- iv. Locus - practice-based vs. class-room based learning
- v. Roles - multi-disciplinary or professional groupings
- vi. Pedagogy - different pedagogical approaches
- vii. Focus - acknowledging different aims
- viii. Direction - instructor-directed vs. autonomous or learner-directed learning.

In their research, Sharpe *et al* (2006) observed three broad characterisations for blended e-learning as it is practised today. These are:

- i. The provision of supplementary resources for learning programmes that are conducted along predominantly traditional lines, through institutionally supported virtual learning environments.
- ii. Transformative course level practices underpinned by radical course designs which often make significant use of technology to replace other modes of teaching and learning.
- iii. A holistic view of technology and learning, including the use of the learners' own technologies to support their learning.

Itmazi and Tmeizeh (2008) defined blended e-learning an approach that mixes both traditional learning and e-learning. They further proposed a pictorial representation of blended e-learning shown in Figure 2-2 below.

Figure 2-2 Blended E-learning



2.3. Forms of Blended E-learning

A review of existing literature reveals that there are primarily four types of blended learning namely, face-to-face plus online, combination of technologies, beyond four walls and combination of real world plus virtual world. Below is a brief a brief overview of each of these forms.

2.3.1. Face-to-Face Plus Online

Face-to-face plus online involves the integration of traditional learning with web-based on-line applications. This form of blended e-learning combines two components namely, the ‘traditional’ training and the delivery of courseware through distance technologies. Gary Motteram and Pete Sharma (2009) noted that this approach normally involves use of a Virtual Learning Environment such as Blackboard or Moodle. They also noted that the distance delivery may involve the use of synchronous tools, such as chat, and asynchronous tools, such as bulletin boards.

2.3.2. Combination of Technologies

Like the name implies, the combination of technologies form combines the media and tools employed in an e-learning environment. Further, this definition could describe a purely distance learning course, where no traditional lessons occur (Oliver & Trigwell, 2005: 17).

2.3.3. Beyond Four Walls

The third use of the term blended learning as suggested by Oliver & Trigwell (2005: 17) is “The combination of a number of pedagogic approaches, irrespective of the learning

technology used”. This definition implies that a course integrates transmissive and constructivist approaches.

2.3.4. Combination of Real World plus Virtual World

Gary Motteram and Pete Sharma (2009) described a combination of real world plus virtual world as the last form of blended learning. They noted that with this approach, the teacher delivers a face-to-face, real world lesson, and then arranges to meet his or her students’ in a virtual world such as Second Life for a follow-up lesson. Further, they argued that, this combination is recent, and shows that the term ‘blended learning’ is a fluid one, and is continuously open to new interpretations.

2.4. Blended Learning in Developed and Developing Countries

Dobrzański and Brom (2008) in their research carried out in Poland found out that students acquire different skills and knowledge at varying pace with the personal support of the teacher and this method of assisting remotely the e-learning students has proved to be efficient. They claimed that the major limitation of their research was that larger population of students should be tested so as to give measurable results, which would imply what needs to be worked on and what changes to introduce in order to improve the e-learning process. From this research it is obvious that there are some research gaps that ought to be filled. Sharpe *et al* (2006) argued that institutional rationales for blended e-learning were highly contextualised and specific to each institution. They noted that the rationales include, flexibility of provision, supporting diversity, enhancing the campus experience, operating in a global context and efficiency.

Zhang *et al.* (2004) noted that, one of limitations of some multimedia-based e-learning systems is that they do not support sufficient learner–content interaction and flexible learning process control. Hammond *et al.* (1995) and Hiltz and Wellman (1997) averred that lack of sufficient control over instructional content can diminish potential learning benefits. Some systems simply post multimedia instructions without any processing or organization. They do not allow random content access. In such cases, e-learning is less likely to hold learners. Again this is another research gap; in developing a blended framework for multimedia based e-learning system the thrust shall be to provide learners with easy, intuitive, and fast access to the learning objects.

Yilmaz and Orhan (2010) reported that blended learning environment (BLE) is increasingly used in the world, especially in university degrees and it is based on integrating web-based learning and face-to-face (FTF) learning environments. Besides integrating different learning environments, BLE also addresses to students with different learning approaches. The ‘learning approach’ categorizes individuals as ‘surface learners’ and ‘deep learners’.

2.5. Blended E-Learning Frameworks

Rossett, Douglis, and Frazee (2003) indicated that there are many different models and blended learning approaches for delivering training. They further claim that such a fact can lead to confusion for practitioners in deciding the optimal blended learning approaches for their organizations. In terms of the current blended learning practices, several blended learning models are being used in workplace learning settings (Bersin, 2004; Bonk and Graham, 2006; Rossett and Frazee, 2006).

Kerres and De Witt (2003) indicated that a conceptual framework for a blended learning arrangement should include guidelines for selecting elements of a blended learning arrangement and for the sequential ordering of these elements. Currently, there is no a single and universally agreed upon framework. This section presents some of the frameworks that have been developed and used in developed countries. Some of the models to be discussed include the 3C-didactical components of a learning arrangement, Badrul Khan's framework, delivery model for blended e-learning and Laurillard's Conversational Framework.

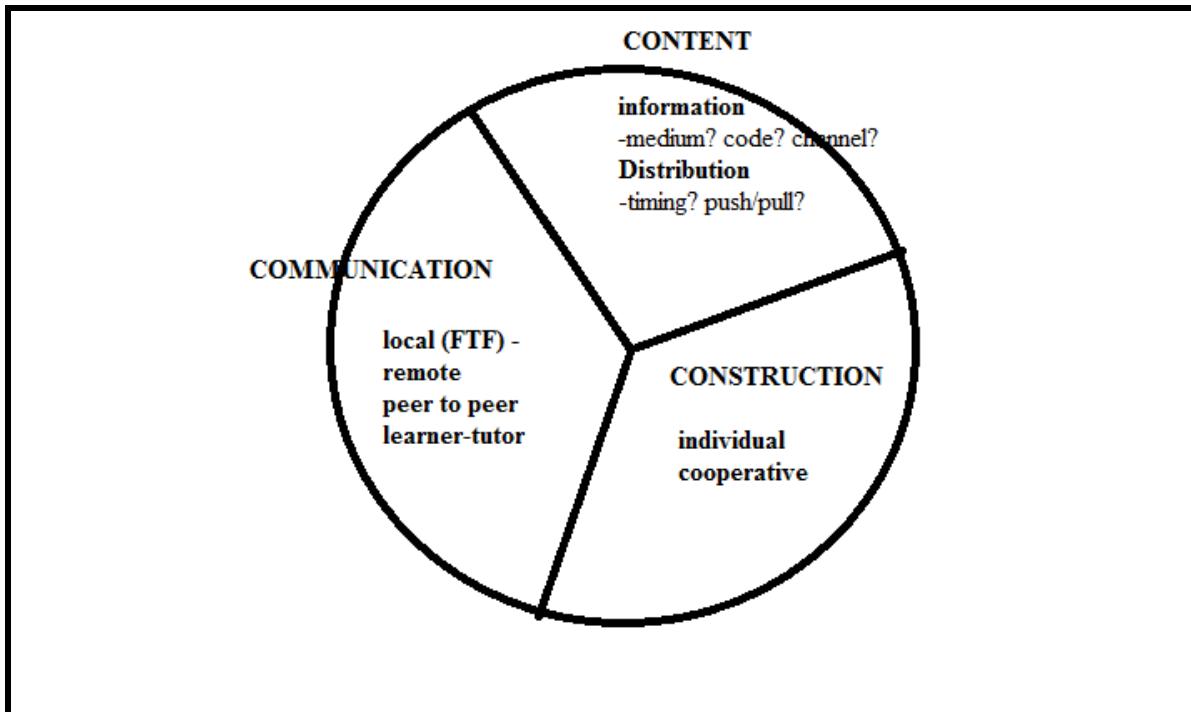
2.5.1. 3C-Didactical Framework for the Design of Blended Learning Arrangements

Kerres and De Witt (2003) indicated that the 3C-Model of didactical components provides a framework for specifying parts of a blended learning arrangement and their relative weight. They further indicated that the first step in this framework involves specifying parts of a blended learning arrangement and their relative weight. In a second step, the delivery format will be chosen based on these didactical decisions. Figure 2-3 overleaf shows the 3C- didactical components of a blended learning arrangement.

Kerres and De Witt (2003) claimed that the model shown in Figure 2-3 overleaf consists of three components namely, a content component that avails the learning material to a learner; a communication component that offers interpersonal exchange between learners or learners and instructors; and a constructive component that facilitates and guides learner as well as cooperative learning activities to actively operate on learning tasks with different degrees of complexity. They further averred that these three components can be delivered in various formats notably, a face-to-face situation, based on exchange media, transmitted as analogue information by air or via cable or as digital packets over the

Internet in a synchronous or asynchronous setting with text, audiovisual or other multimedia elements.

Figure 2-3 Components of a Blended Learning Arrangement

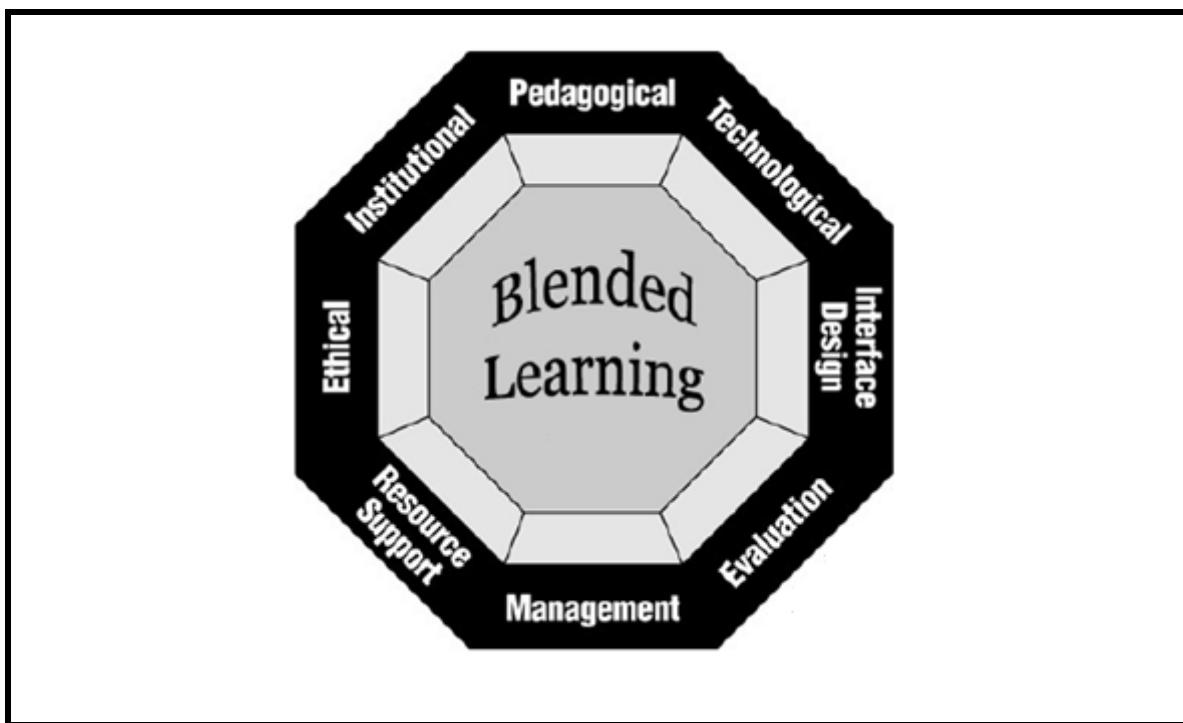


2.5.2. Badrul Khan's Framework for E-learning

Singh (2003) noted that Badrul Khan's blended e-learning framework is also known as Khan's Octagonal Framework. The framework is shown in Figure 2-4 overleaf. Singh (2003) further postulated that Khan's framework serves as a guide to plan, develop, deliver, manage, and evaluate blended learning programs. They also indicated that organizations exploring strategies for effective learning and performance have to consider a variety of issues to ensure effective delivery of learning and thus a high return on investment.

Al-Huwail, Al-Sharhan and Al-Hunaiyyan (2007) argued that major drawback with Badrul Khan's framework is that it does not include a main group of cultural factors. It is worth noting that although the framework presents the cultural diversity under the Ethics group; it is strongly believed that that the cultural diversity is one element of the critical cultural factors of a successful blended e-learning. Al-Huwail, Al-Sharhan and Al-Hunaiyyan (2007) suggested that the Brudal Khan Framework can be can be dramatically enhanced by adding a group of "cultural factors"

Figure 2-4 Khan's Octagonal Framework



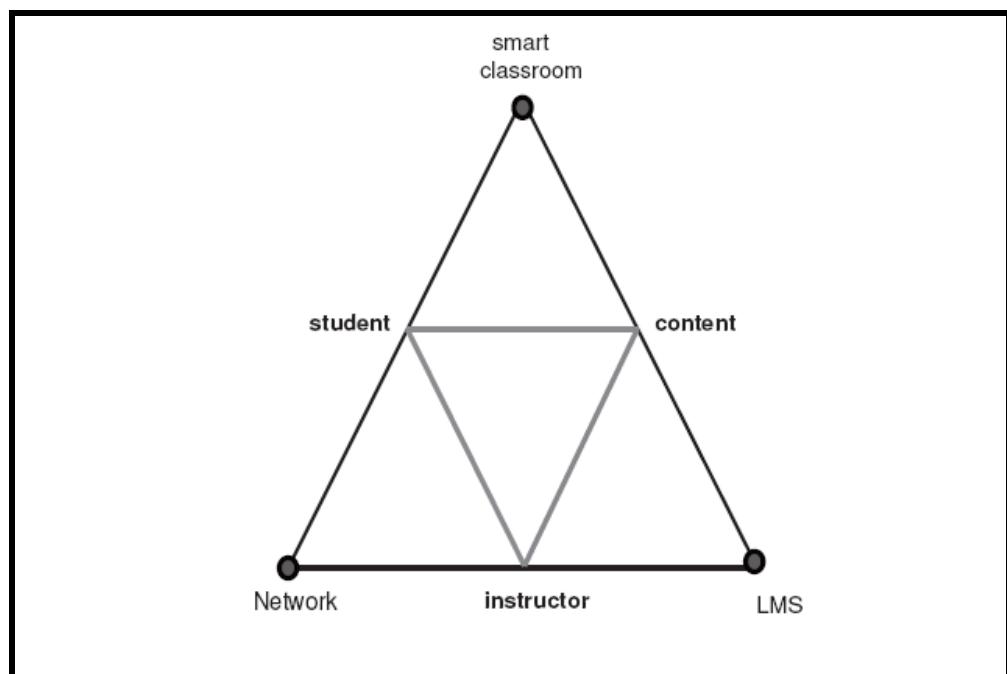
2.5.3. Delivery Model for Blended E-learning

The framework is shown in Figure 2-5 overleaf. In the framework, Al-Huwail, Al-Sharhan and Al-Hunaiyyan (2007) defined the delivery environment as the medium where the learning and teaching process are taking place. Further, they suggested that the elements of the environment are the learning management system, multimedia equipped classrooms (smart classrooms), and network or the Internet. Al-Huwail, Al-Sharhan and

Al-Hunaiyyan (2007) proposed a new framework for the delivery environment in blended e-learning.

Al-Huwail, Al-Sharhan and Al-Hunaiyyan (2007) established that in view of the proposed framework presented below, the learning activities in blended e-learning process can be summarized as follows: students meet with instructor in smart classrooms. The instructor guides the learning process by utilizing the online content where students access the content via the network (Internet). The LMS tracks the learning activities and provides the instructor with performance report about the learning process.

Figure 2-5 Delivery Environment Framework



Furthermore, they claim that the above model shows the relationship between students (subject), learning objects or content (object) and the role of the instructor as facilitator (role). The interaction is mediated by the Internet and the LMS (tools) and the

collaborations taken place between students online or in the smart classroom (community). They further noted that in this environment cultural issues and phenomenon play a key role in creating a successful collaborative environment. The aforementioned activities form the basis upon which individuals interact with objects, people, and tools. For this reason, examining cultural factors related to cultural activities is critical for establishing a successful blended e-learning environment. They also indicated that examples of these factors include communication language, technical, social, political, economical, and religious factors.

In the above framework, the network is the medium of delivery. They further noted that the Learning Management System (LMS) is the other main factor in the delivery environment. Concerning this issue, there are several LMSs by different vendors and as such implementers of blended e-learning adopters must choose the LMS that is commensurate with the delivery environment. Among other things, the LMS should support transparently, easy and smooth navigation through system and learning content, monitoring and tracking of learner performance, communication with the instructor and peers, a wide variety of reports, navigation through assessment material and usability of the learning objects and contents (Al-Huwail, Al-Sharhan and Al-Hunaiyyan, 2007).

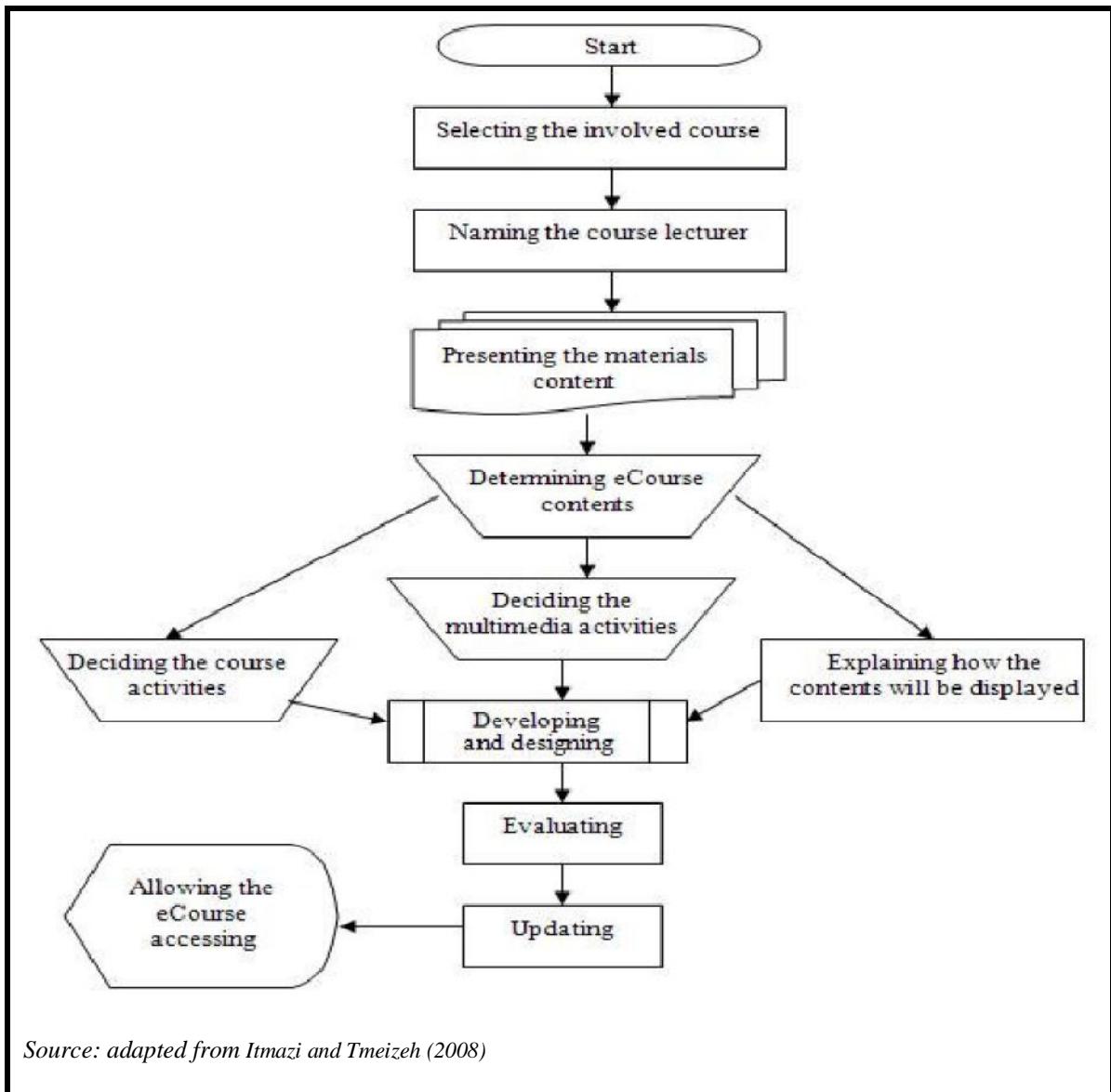
2.5.4. Framework of E-Course Development Steps

Itmazi and Tmeizeh (2008) established that the framework of e-course development has eight steps outlined below. Figure 2-6 overleaf presents the framework of e-course development steps. The steps are as shown below:

1. Selecting the involved course which will be developed.
2. Naming the course lecturer(s).

3. Presenting the materials content: the chosen course lecturer presents all the materials content of the target course such as: books, documents, manuals and digital materials.
4. Determining the e-course contents by the lecturer.
5. Explaining how the contents will be displayed: the lecturer with cooperation of pedagogical expert determines how the contents will be displayed, the tools which will be used and the suitable content format, for example using PDF, Presentation, Text, HTTB, WIKI, XML and so on.
6. Deciding the multimedia activities: the lecturer with cooperation of pedagogical expert decides which parts and activities need to be designed as multimedia.
7. Deciding the course activities: the lecturer with cooperation of pedagogical expert decides the suitable course activities, for example assignments, homework, chats, glossaries, quizzes and resources.
8. Developing and designing: the lecturer develops the selected contents and activities and the multimedia technician designs the multimedia then put all in the target e-course.
9. Evaluating: the Quality Unit insures that the e-course fits its quality assurance procedures.
10. Updating: the lecture with cooperation with the programmer makes the final modification upon the evaluation notes.
11. Allowing the e-course accessing.

Figure 2-6 Framework of E-Course Development Steps

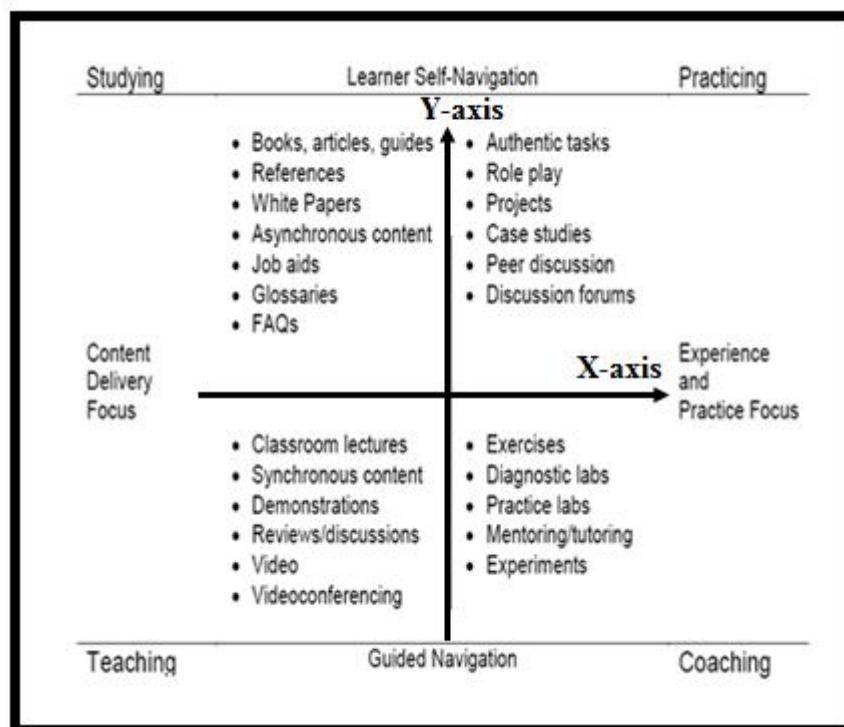


2.5.5. Learning Ecology Matrix

Sabine Annegret Moebs (2007) presented another framework for blended e-learning which was developed by Wenger and Ferguson. Sabine Annegret Moebs (2007) noted that poor design of blended learning material can lead to much poorer learning results in a blended environment compared to a single method of delivery. Wenger and Ferguson (2006) are some of the researchers who developed a framework which was destined to counter the raised concern. Their framework was designed to guide the design and

deployment of company training and courses. Their approach consisted of three steps: the first involves developing the learning ecology matrix. In the matrix, the x-axis illustrates the focus on the delivery of instruction that varies from “content delivery focus” to “experience and practice focus”; whereas the y-axis illustrates controls the navigation of the learning process that varies from “guided navigation” to “learner self-navigation”. The second step involves including four general learning modalities namely, studying, practicing, teaching and coaching. These modalities do not refer to either classroom or e-learning, but are rather applicable to both. The third step relates to completing the matrix with distinct instructional, learning and knowledge elements. Figure 2-7 below shows the framework by Wenger and Ferguson.

Figure 2-7 Learning Ecology Matrix



The above learning ecology matrix is geared at delivering a high quality learning experience and at providing control over the learning experience for both the learner and the instructor. It strives at combining formal and informal learning rather than positioning

them as opponents. The social nature of learning has to be considered in all learning elements. The aspect of cost-effectiveness is recognized, but merely in the sense that any project aims at a combination of learning outcomes at a minimum total cost.

2.5.6. Generic Framework for Blended Learning

McSporran and King (2005) presented another framework for blended learning called the generic framework for blended e-learning. This framework enables a structured combination of educational delivery methods. Table 2-1 below shows the generic framework for blended learning.

Table 2-1 Generic Framework for Blended Learning

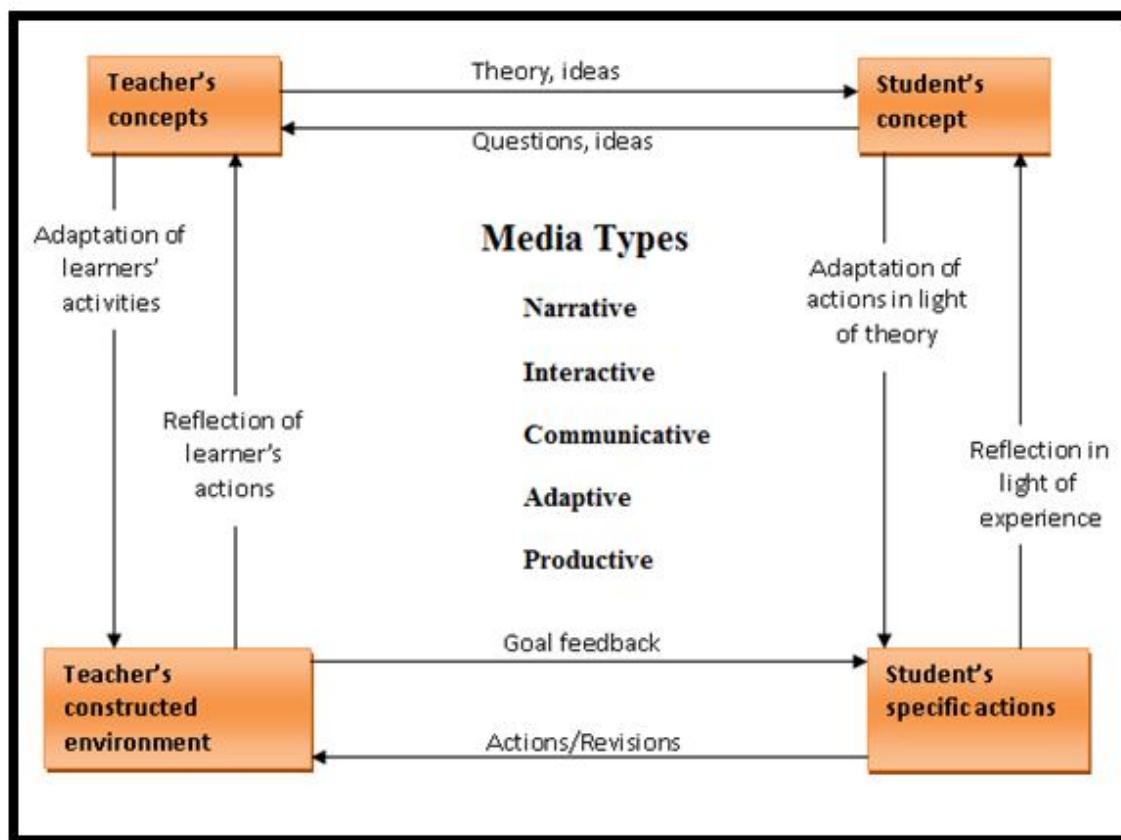
A	B	C	D	E	F	G
Category of learning needs	Examples	Possible methods	Benefits	Constraints /difficulties	Likely effectiveness	Possible blend
This column is used to describe the skills or concepts that need to be learned	Example place the learning needs in context	A selection from a given list or other methods	Allows author to clarify benefits of particular selected method. Used a check	Indicates possible challenges to implementation	Provides ranking for selected method. Used in conjunction with columns D and E	Suggestions of complementary methods

They also noted that the above framework is intended to provide guidance for the selection of delivery methods, considering the learning needs as well as available resources. Benefits, difficulties, constraints, but also complementary methods are listed to provide the information necessary to develop the right blend. The generic framework is then applied to specific learning needs.

2.5.7. Laurillard's Conversational Framework

Laurillard (1993, 2002) claimed that there are four main aspects of the teaching-learning process and that different educational media can be analyzed (and used) in terms of these dimensions. This framework can be considered both a learning theory and a practical framework for designing educational environments. Higher education, according to Laurillard is much about acquiring "ways of seeing the world". Laurillard's conversational framework is shown in Figure 2-8 below.

Figure 2-8 Laurillard's Conversational Framework



The above framework is a valuable tool for blended learning. Laurillard's framework includes four important components namely, teacher's concepts, teacher's constructed learning environment, student's concepts and student's specific actions linked to learning

activities. Each pedagogical situation must encompass all four kinds of activities that occurred in eight types of flows in the above framework.

The first type of activity is discussion between the instructor and the learner. Here instructors' conception and learners' conception must be mutually accessible and both should agree on objectives of learning. The second type of activity is adaptation of the learners' actions and of the teacher's constructed environment. With this activity, the instructor should adapt objectives with regards to existing conceptions and learners must integrate feedback and link it to his own conceptions.

The third type of activity is interaction between the learner and the environment defined by the teacher. Under this activity, the instructor must "adapt to world", that is create an environment adapted to the learning task given to the learner and the instructor must also focus on support for task and give appropriate feedback to the learner. The last type of activity is reflection of the learner's performance by both teacher and learner. Here, the instructor must assist the learner to revise his conceptions and to adapt the task to learning needs and learners should reflect with all stages of the learning process that is initial concepts, tasks, objectives, feedback and so on.

As regards media activities, Philipps (1988) maintained that:

"Laurillard argues that the only use of technology which can meet these aims is the 'multimedia tutorial simulation', characterized in terms of guided discovery learning. Here schema is based on forming an information rich environment in which the student has control in discovering knowledge, but the discovery is supported and scaffolded by extra guidance functions (Laurillard, 1993) which

provide support and feedback for subsequent learning. These functions are analogous to the coaching and scaffolding at critical times proposed in the Situated Cognition Theory.”

Laurillard (1993) indicated that different forms of media provide a different level of support for various kinds of learning experiences. She identifies five media forms namely, narrative, interactive, communicative, adaptive and productive. Conole and Fill (2005), suggested that,

“Narrative media tell or show the learner something (eg. text, image). Interactive media respond in a limited way to what the learner does (eg. search engines, multiple choice tests, and simple models). Communicative media facilitate exchanges between people (eg mail, discussion forum). Adaptive media are changed by what the learner does (eg some simulations, virtual worlds). Productive media allow the leaner to produce something (eg word processor, spreadsheet)”

Peter Clinch (2005) presented Table 2-2 below which shows learning experiences, method and form of media that applies to the first two.

Table 2-2 Learning Experiences, Methodology and Media Forms

Learning experience	Method/Technologies	Media forms
attending, apprehending	print, TV, video, DVD	Narrative
investigating, exploring	library, CD, DVD, Web resources	Interactive
discussing, debating	seminar, online conference	communicative
experimenting, practising	laboratory, field trip, simulation	Adaptive
articulating, expressing	essay, product, animation, model	Productive

Eddie Gulg, (2006) suggested that when developing the blend you need to be clear about the level of learner autonomy that you are seeking to build into the programme, that is, if you require learners to take responsibility for their own learning and, in so doing, select how, when and where to learn, they must have the responsibility, skills and motivation to make those decisions for them. He further noted that, the design of the blended learning mix needs to be built around the fundamental ways in which people learn. Individuals acquire knowledge and skills through a blend of many different experiences such as reading, observation, collaboration, trial and error, guided practice, application and experimentation. These same learning principles should be built upon to develop your blended learning programme. (Eddie Gulg, 2006).

2.6. Mix of Tools in Blended E-learning

In their study of blended e-learning in traditional Palestine universities, Itmazi and Tmeizeh (2008) observed that in blended e-leaning, teachers and students are requested to attend simultaneously a classroom (face-to-face) during 25 per cent to 75 per cent of the total academic time. They further accentuated that adopting blended e-learning can help the diverse needs of a growing student population by reducing the seat-time courses. On the whole, every course offered by blended e-learning will reduce 50 per cent of the seat time in medium (the ratio for the academic time of blended e-learning vary from 25 per cent up to 75 per cent), so if any university offers 10 per cent of its courses via blended e-learning, it will be able to increase its capacity up to 15 per cent without any change in its building, classrooms and labs (Itmazi and Tmeizeh, 2008)

Fernando J. Mortera-Guitierrez (2005) established that the following elements are the most used within blended situations in order of relevance:

- Face-to-face instruction
- Print-based workbooks
- Self-paced content such as CD-ROM
- Performance support tools (eg collaboration software, threaded discussions, online testing)
- Teletraining for example video and audio conferencing.
- Virtual classroom or stand-alone web-based training and learning
- Asynchronous web-based training/ online instruction
- Synchronous web-based training

From the forgoing list it is clear that face to face instruction must constitute the greatest proportion in a blended e-learning system but the actual proportions are not given. This contradicts with what was proposed by Kerres and De Witt (2003). They postulate that the blended learning arrangement consists of three components namely, communication, content and construction. In addition, they indicate that learning arrangements differ in relative weight of these components and as such, as a rule of thumb, one third of the learning time should be devoted to each component.

Eddie Gulc, (2006) noted that the blended learning mix will offer a variety of teaching and learning styles, course materials and learning technologies such as: traditional classroom or lecture theatre or laboratory environment, CD-ROM/DVD, E-mail or SMS, E-books, VLEs, including message boards and chat rooms, Asynchronous online delivery or tools, like, wikis and blogs, synchronous online delivery or tools, like instant messaging. He further postulated that the best approach to developing a blended learning pedagogy is to evaluate the materials and practices currently being used by your learners

and establish how your programmes can be improved or enhanced with technology. The author also established that the right solution for each programme, and indeed each learner, depends on the balance of learning provided within the blended learning mix. Success will only come from blended learning where a review of the learning programme enables it to be broken down into modules, and where the tutor can assess the best medium to deliver each of those modules to individual learners (Eddie Gulg, 2006)

Graham and Valsamidis (2006) stated that: “There is absolutely no evidence that learners are able or willing to do without teachers, no matter how well designed the materials, how extensive the resources or how ‘just in time’ the learning. The fundamental role of the teacher or tutor has not changed but the mode of operation has”. Further, Graham and Valsamidis (2006) carried out research in UK universities where he used experiential data from students on Information Systems, Multimedia, and Computer Science programmes within his university. He concluded that no more than thirty percent of their courses in total (their management, content and delivery, etc) should be “e”.

Fernando J Mortera-Gutierrez (2006) notes that the balance between online and face-to-face components will vary for every course. Some blended courses because of the nature of their instructional goals, student characteristics, instructor background, and online resources, will include more face-to-face than online strategies. Other courses will tip the balance in favour of online strategies, using face-to-face contact infrequently. Still others will mix the two forms of instruction somewhat equally

2.7. Effect of Blended E-learning on Learning Outcomes

On the impact of blended e-learning on learning outcomes, literature shows that, blended learning improves performance, provides stronger understanding and increases retention of the subject (Rossett and Frazee, 2006; Itmazi and Tmeizeh, 2008). Further supporting evidence is presented by Wei Zhou, Takami Yasuda, and Shigeki Yokoi (2007). In their evaluations in Japan from January to February of 2005 at the Nagoya Mizuho Youth House, they demonstrated the high usability and usefulness of blended learning support system and that it can effectively improve learning and motivation. Similar results were found by Sharpe *et al* (2006). They carried out research at London Metropolitan University and University of Bolton where they introduced a redesigned and blended introductory programming course. They reported that pass rates increased by 12-23 per cent on the previous year in the modules which followed this blended approach.

Dongsong Zhang (2005) conducted two experiments to assess effectiveness of interactive e-learning in the Department of Information Systems at the University of Maryland in Baltimore County. The author reported that students in a fully interactive multimedia-based e-learning environment achieved better performance and higher levels of satisfaction than those in a traditional classroom and those in a less interactive e-learning environment. Further supporting evidence was presented by Sharpe *et al* (2006). They carried out research at the University of Dundee in which they introduced computer aided assessments into an introductory chemistry course. They observed that the pass rate improved from 73 per cent to 93 per cent.

Davies (2004) reported improved development of higher order thinking skills by higher performing students through an online peer marking exercise. However, the author, argue

that, no doubt the computerised marking process facilitated the design and delivery of the exercise but it is unclear the extent to which peer marking, the use of technology, or the combination of both led to improved outcomes. In contrast to the above, Kennedy and Cutts (2005) investigated the impact of electronic voting systems (EVS) in a first year computing subject in an Australian university. They found a significant correlation between performance on the module and level of accurate responses using EVS during lectures.

Further research on this area was carried out by Davies and Graff (2005). They looked for a correlation between level of interaction in online discussion groups and final grades. They concluded that, despite some associations between levels of online activity and grades, higher levels of participation did not necessarily result in better grades. They further commented that, an association between online participation and grades might have been more likely if the variable had been quality rather than quantity of participation. Different results were found in America by Cook, Cohen and Owsten (2003). They evaluated technology enhancements to a large (444 students) introductory macroeconomics course. They triangulated data from server log files, a survey, a focus group and the text of an online discussion thread that sought students' reactions to the use of technology in the course. They also compared and found significant positive correlations between students' number of hits and overall course mark and number of sessions and overall course mark.

Most recent researches that indicate that blended learning approaches improve learning outcomes relate to use of computer aided assessment (CAA). In line with this, Morris and Walker (2006) at the University of Dundee showed improved student outcomes in the

form of course or module results. Their project involved the radical redesign of a first year Chemistry course that incorporated formative and summative use of CAA. Regular and frequent formative online quizzes were introduced with multiple attempts allowed on each and feedback on incorrect answers was provided. They found that the pass rate rose from 73 per cent to 93 per cent between successive cohorts with the introduction of CAA. Comparison of the entry qualifications of the cohorts showed a slightly less qualified CAA cohort than their predecessors. Similar effects of CAA were found by Catley (2004), who introduced optional formative quizzes in a compulsory first year law module and kept all other aspects of the teaching and learning programme the same as before. Students who did the optional quizzes performed significantly better than those who did not and there was a rise in the pass rate and in the number of first classes in the module

Batane and Mafote (2007) reported on an investigation that was done among University of Botswana students to find out their perception about the impact of WebCT on their learning and whether they thought it was worthwhile investment. Students in the study reported that WebCT greatly improved their learning in that it easily made available course material that they would otherwise struggle to get through searching the library or laboriously writing extensive notes in class. Students also reported that WebCT enabled them to participate in online discussions that greatly contribute to their course understanding. Similar results are presented by Dziuban *et al* (2006). They reported that the learning outcomes of students in blended courses (that is academic achievements and withdrawal rates) are equal or superior to that of students in face-to-face or online courses. Further supporting evidence is presented by Dziuban *et al.* (2004) and Wingard (2004). They established that higher education instructors have a high level of satisfaction

with blended courses, due largely to increased flexibility and enhanced interactions in Web-enhanced environments.

2.8. Effect of Blended E-learning on Satisfaction

There is considerable evidence on the impact of blended e-learning on satisfaction. Itmazi and Tmeizeh (2008) outlining the benefits of blended e-learning claimed that with blended e-learning, learners may study at their own pace and speed, so it increases satisfaction and reduces stress, also they can skip understood activities or materials and jump to new issues. Further, Weyers *et al* (2004) cited in Sharpe *et al* (2006) conducted an institutional survey at the University of Dundee and reported that there were generally high levels of satisfaction with their Virtual Learning Environment.

Similar results to the foregoing results were found by O'Toole and Absalom (2003) in an Australian university. They noted that lecture attendance had dropped with the introduction of full text notes and recommended readings to mirror the lectures. In this example of evidence informed teaching, they stated that the outset of the study that the results will inform what they do next: either to move towards virtual tutorials or remove the existing material from the internet and encourage lecture attendance. They found that students who attended lectures outperformed all other groupings of students by about 20 per cent in a surprise quiz in the last tutorial of term.

In their study comparing courses entirely on-line with traditional face-to-face, Sikora and Carroll (2002) reported lower satisfaction ratings with the fully on-line course(s) compared to the traditional course(s). Additionally, Carr (2000) finds higher attrition rates in fully on-line courses. Moreover, some blended learning approaches are adopted as a

means to address pervasive dissatisfaction of online students with the lack of a sense of community in their online classes due, in large part, to the lack of FTF interactions (Lee and Im, 2006; Osguthorpe and Graham, 2003).

Several studies have been conducted to compare the effectiveness of blended courses with face-to-face or online courses. Boyle, Bradley, Chalk, Jones, and Pickard, (2003); Lee and Im, (2006); Lim, Morris, and Kupritz (2006) reported that results of several higher education research studies suggest that learner satisfaction and learning outcomes can be superior in blended learning settings compared to those in online settings. A study by Thomson NETg (2003) of learners in both education and training settings indicated that learner satisfaction and learning outcomes – Level 1 and Level 2 evaluations in Kirkpatrick's (1994) model for evaluating training programs – were higher in blended courses than in e-learning courses.

Dongsong Zhang (2005) indicated that interaction is a fundamental factor for learner satisfaction, higher levels of academic achievement, higher learner engagement, and a positive attitude toward distance education. Previous researches have reported mixed results. Some found that students were satisfied with e-learning (Amir, Iqbal, and Yasin 1999), whereas others revealed that students were less satisfied (Rivera and McAlister 2001). Piotrow *et al.* (2000) also noted that both multimedia instruction and high levels of interaction can lead to increased learner satisfaction.

Yilmaz and Orhan (2010) investigated whether the academic performance and the satisfaction levels of the pre-service English teachers varied in respect to their learning approaches in a blended learning environment. They reported that 1) academic

performance scores of the students in the BLE did not show statistically significant difference between deep and surface learners, 2) the average satisfaction level with the BLE of deep learner students was statistically significantly higher than the average of surface learner students. Based on these findings, it can be concluded that pre-service English Language teachers were in general highly satisfied with the BLE. In addition, it can be stated that the courses which are designed for the BLE contribute to the achievement of the students with surface learning approach.

Sharpe *et al* (2006) reported on a study aimed at investigating graduate nursing students' satisfaction with a course taught via interactive video teleconferencing (IVT) and the World Wide Web or Internet (WWW/INT). A correlational research design examined the relationships among five learner attributes and three instructional variables and student satisfaction. Regression analyses identified learner attributes and instructional variables predictive of student satisfaction.

Biner *et al* (1996) reported on an investigation in which 699 undergraduate and graduate students enrolled in 33 live, interactive telecourses were asked to report their 1) telecourse facet satisfaction (satisfaction with the telecourse instruction or instructor, technology, and logistic or management), 2) demographic characteristics (age, gender, personal income, and socioeconomic status), and 3) experience with televised courses (number of prior telecourses they had completed). They reported that, among the demographic variables, gender reliably predicted student satisfaction with the logistic or management aspects of the telecourses, that is, male students reported being significantly more satisfied than female students with these aspects of the courses. Finally, greater telecourse

experience was significantly associated with lower degrees of instruction or instructor satisfaction.

Giannousi *et al* (2001) carried out research whose purpose was to investigate the effectiveness of blended learning instruction in terms of students' satisfaction. They reported that, perceived e-learner satisfaction was higher than the average indicating students' high satisfaction with the overall learning experience. Students seemed satisfied from the way the course's context was delivered to them. The results also indicated that 54 per cent of the students were looking forward to take another blended course. Such findings corresponded to previous studies (Biner *et al*, 1996; Arbaugh, 2004), which indicated that simply asking students whether they would enrol in another distance education course could determine students' satisfaction with the course they are taking. This finding suggests that a blended learning format can be a viable option to maintain and maybe even increase student satisfaction.

Arbaugh (2004); Flowers, Moore III, and Flowers (2008) pointed out that students with more exposure to distance education settings were more likely to express greater satisfaction with the learning environment than with traditional courses. They further noted that only the 21 per cent of the students expressed a negative opinion about the possibility of attending a blended course at the future. The explanation for this might be that 15 per cent of the students had little or small exposure to blended learning settings since they attended none or only one course with a similar learning environment.

2.9. Multimedia Based E-Learning

Al-Huwail, Al-Sharhan and Al-Hunaiyyan (2007) argued that, instructors often hear about the positive effects of e-learning systems that is being used somewhere and wonder if it would be useful in their own setting. When such a transfer of electronic learning occurs across different countries and cultures, there is a problem of portability. Further supporting evidence was presented by Gujar and Sonone (2004). They mentioned in their study that the adoption of educational and training to multicultural settings requires a new paradigm that includes an understanding of the deeper psychology of culture and the unique differences culture brings to a global workplace.

Kerres and De Witt (2003) indicated that digital media will not substitute traditional approaches to learning and teaching as advocated by some e-learning enthusiasts a few years ago. Digital media do not question the existence of teachers or educational institutions as such and they will coexist with traditional approaches of teaching and training. In many cases, computer-based or internet-based trainings are accompanied by face-to-face (FTF) meetings to ensure the quality of learning and to reduce dropouts. The now widely adopted term ‘blended learning’ refers to all combinations of FTF learning with technology-based learning: traditional education can be enriched with the use of technology and learning with technology can profit from FTF meetings. The term blended learning, however, is still quite vague and does not provide a conceptual framework.

2.10. Conclusion

This chapter gave an outline of literature that is relevant to the study. More specifically, the chapter began by reviewing literature on e-learning. After that, blended e-learning frameworks that have been developed and implemented elsewhere were presented.

Further to that, the chapter looked at the impact of multimedia based e-learning system on learning outcomes and satisfaction. Lastly, the literature explored the various mixes of learning methods adopted by various institutions and also looked at experiences by both developing and developed countries in the use of blended learning.

CHAPTER THREE

3. Research Methodology

3.1. Introduction

This chapter presents the methodology for the study. Firstly, the chapter begins by describing the tools used in the research and the approach followed in addressing research objectives. Here, attention is paid to approaches that were used in measuring the level of satisfaction with the blended multimedia-based e-learning approach and the impact that the blended multimedia-based e-learning approach has on learning outcomes of students. In addition, the chapter will explore on how the optimal mix of components in the blended multimedia-based e-learning approach can be determined. Lastly, the chapter outlines how a suitable framework for the blended multimedia-based e-learning approach (BMBELA) is developed.

3.2. Research Tools

The study used version 1.9 of open source software called Claroline. This version was used because it was the latest one when the research commenced. Claroline is not the only open source software that could have been used. Other open source software such as Moodle could have been used but Claroline was chosen because it is the software that the University of Zimbabwe is using for its text-based e-learning system. The advantage with using Claroline was that students were already familiar with the software as such no training in using the system was necessary unlike in the case of introducing a new system. This learning management system works with Apache Web Server, PHP and a MySQL relational database. In this research, WampServer2.0 was used. WampServer2.0 is a suite containing Apache version 2.2.11, PHP version 5.2.9-2 and MySQL version 5.1.33.

All the software outlined in the foregoing is open source. The software was downloaded from the internet and installed. WampServer2.0 was installed first then Claroline. A

server was one hardware requirement. The specification for the server were Windows XP operating system, 40 gigabytes hard disk, 256 RAM, The system was hosted on a local area network implying that it was accessible only on campus. For easy of administration, the server was in the office of the researcher. The server was up for 24 hours a day thorough out the duration of experiment except in instances where there were power cuts.

A course in Theory of Computation (CT 324) was used as a control group. The justification for choosing CT 324 as the control group was that the course is done by all final years (Honours, BSc and Business Studies and Computing Science students). Apart from that, since these students were final years, they had vast experience in using the text-based system unlike the first year students who did not have much exposure to the text-based system. Here any other final year course such as CT 316 could have been used.

However, CT 324 was used because it was one of the courses being taught by the researcher using the blended text-based e-learning approach (BTBELA). In this instance, the researcher had more control over the administration of the course unlike a situation where the course is being taught by another lecturer. Some other lecturers teach their courses using the pure traditional face-to-face approach while others use the e-learning platform inconsistently hence the need to use a course which was taught by the researcher to ensure that there was consistency in the use of the e-learning platform.

For the control group (CT 324), only the interface for the e-learning system was changed. After the modification, course content for CT 324 was uploaded on the platform. For this course, all learning objects uploaded were in text format. More specifically, the course

outlines and lecture notes for all the topics on the course outline were uploaded. The lecture notes for each topic were in all cases uploaded before the topic was taught so that students could download them and read them before lectures. The uploaded learning objects were left on the platform until the end of the semester. Also, assignment questions and discussion questions were uploaded so that learners could engage in discussions among themselves.

Still on the control group, learners were allowed to self register for the course and log on to the platform as often as they wanted. Students also submitted their assignments through the text-based e-learning system and feedback was given through the same platform. In addition to the foregoing, traditional face-to-face lectures were also conducted for each and every topic on the course outline. The face-to-face lectures were conducted three times per week and each session was one hour long. This experiment ran for a semester which was approximately 15 weeks.

A course in Business Management for Scientists (BSC 126) was used as the experimental group. The justification was that it was a new course unlike all other courses which were being offered in the department and also that the course was being done by second year students who had high computer literacy skills just like final year students. This group of students was independent from the control group since the control group included only final years.

As for the experimental group (BSC 126), the code for Claroline was modified to allow the system to accommodate video and audio files in addition to text files. The interface for the system was the same as that for the text-based e-learning system. This was so to

ensure that interface related issues did not have an influence one group and not influence the other.

The researcher then produced text files and audio files which were uploaded on the platform as word, PDF and mp3 files. The mp3 files were developed by reading out the text files and recording output using Power Producer which is one of the software in the Cyberlink DVD suite. As for video files, relevant files were downloaded from the internet and then edited using Power Producer. The multimedia files were uploaded just before the start of each topic and were left on the platform until students had written their end of semester examinations.

The experiment was done for a semester which was approximately 15 weeks. This duration was just the same as the duration for the control group experiment. Students were advised to self register on the e-learning platform. Further, all assignment questions were posted on the platform and all assignment submissions were also uploaded on the platform and feedback was also uploaded on the platform. Also, discussions question were also posted on platform. The system was accessible only on campus because it was hosted on a local area network.

In addition to the foregoing, traditional face-to-face lectures were also conducted for all but one topic on the course outline. The topic was taught using the problem based learning (PBL) approach which is a version of the blended e-learning approach. The topic was on formulation of business plans. The topic was chosen because of its practical nature and also because the PBL approach just suits this kind of a topic. The face-to-face

lectures were conducted three times per week and each session was one hour long. This experiment ran for a semester which was approximately 15 weeks.

3.3. Methodology for Measuring the Impact of BMBELA on Satisfaction

In an attempt to determine the level of student satisfaction with the blended multimedia-based e-learning approach, the researcher used the two courses indicated in section 3.2 above. The blended multimedia-based e-learning approach was used to teach BSC 126 the experimental group. On the other hand, the blended text-based e-learning approach was used to teach CT 324 - the control group. As is indicated in the foregoing, both courses were taught for a semester and then on completion of each course, questionnaires were administered to respective groups to collect information about the level of satisfaction of each group with the approach used in teaching the course.

Use of questionnaires is justified by the fact that students were free to express their opinion unlike use of interviews where they may feel intimidated and fail to express their free opinion. Further, use of questionnaires was the best approach because the identity of the respondents is concealed unlike when interviews are used. The other advantage of questionnaires is that they are not time consuming when compared to interviews. Lastly, approaches such as observation are not suitable here since one cannot observe one's level of satisfaction. Each of the two types of questionnaires used had two sections one on demographic variables and the other on satisfaction variables. In total, each questionnaire had 15 questions.

These questionnaires used satisfaction variables such as the frequency of logging on to the system, the extent to which the approach served the learning needs, the level of

disappointment with the system, the willingness to take another course through the same approach, liking the approach, enjoying reading content from the platform to improve learning, comfort in using the system, having time to explore the platform, enjoying use of the platform, attractiveness of the platform, and establishing which of the two platforms better than face-to-face.

As regards the BSC 126 course that had an enrolment of 32 students, a total of 32 questionnaires were issued to the students. The justification for using this approach was that the population was small hence there was no need for sampling. The researcher issued out the questionnaires to participants during the last lecture of the semester. The students were then given 30 minutes which was enough to complete the questionnaire. The approach was most effective because it yielded a high responds rate when compared to the approach wherein the questionaries are issued and students take them home and complete them before returning them at some future date.

However, the draw back with this approach is that, although the responds rate is always high it is never 100 per cent because some questionnaires will not returned and some would be returned but will be spoiled. Some forms of spoil are, some questions may be not completed and also that some may have more than one answer in cases where they are required to tick just one box.

As regards CT 324 - the control group, the course that had an enrolment of 61 students, 61 questionnaires were administered to the students. The justification for using this approach was that the population was again small hence there was no need of sampling. The researcher issued out the questionnaires to participants during the last lecture of the

semester. The students were then given 30 minutes which were enough to complete the questionnaire. The advantages and disadvantages of this approach are similar to those raised in the foregoing section on the experimental group.

3.4. Methodology for Measuring the Impact of BMBELA on Learning Outcomes

In an undertaking to gauge the impact of the blended multimedia-based e-learning approach on the learning outcomes of students, the researcher used the above mentioned control and experimental groups. In this design CT 324 was again used as the control group and BSC 126 was used as the experimental group. The learning outcomes were measured by giving students tests, assignments and final examinations. The beauty of this approach is that it uses average final marks which take into account the continuous assessment and the final examination mark. This is just but the best approach to measuring the performance of students in a given course. Also, the final mark is not biased since it is based on both the continuous assessment mark and the final examination mark.

In both courses, students were given two assignments and two tests (course work) plus the final examination. The tests in both courses were issued midway the semester and at the end of the semester. The duration of each test was two hours and all questions were compulsory and all tests were out of 100 marks. As regards the assignments, for both courses, one was a group assignment and the other an individual assignment. On all occasions students were given two weeks to do the assignment. As regards the group assignments, the one for BSC 126 was done using the PBL approach wherein the students were required to come up with a business plan. On the other hand, CT 324 students were given a group project. In both cases, each group had a maximum of five students. The

group assignments in both cases were issued at the beginning of the semester and were due at the end of the semester.

As for the final examinations, the duration for both each paper was two hours and each paper had six questions each worth 25 marks and students were required to choose any four questions. The overall mark for each student in each course was calculated by taking 30 per cent of course work plus 70 per cent of the final exam.

This approach is not without some weaknesses. One of the major drawbacks associated with the above approach is that the level of difficulty of examinations might differ and also that the actual courses chosen might not necessarily be equally difficult or easy. The beauty about the approach is that it gives a clue on the impact that the blended multimedia-based learning approach has on learning outcomes.

3.5. Methodology for Developing an Optimal Mix for BMBELA

In establishing the best mix of elements in the blended multimedia-based e-learning approach, the researcher used a questionnaire. This was a ten-item questionnaire which was developed to solicit information from lecturers and students in the Department of Computer Science about the optimal mix of tools. Since the lecturers and the students are the people involved here, the best approach was to solicit information from them about what they think is the best mix.

Apart from using questionnaires the information can be collected from respondents through observations and interviews. These two approaches are inappropriate because biased information will be collected. For instance if respondents were interviewed they

would not be free to express their free opinion and this approach is time consuming. The observation approach cannot work here because one cannot come up with the best mix by mere observance of how lectures are conducted.

The questionnaire had two sections one on demographics and the other on the optimal mix of components that go into blended multimedia-based e-learning. The variables which were on the questionnaire include but are not limited to the percentage of traditional face-to-face that must go into blended e-learning, percentage of pure e-learning that must go into blended e-learning and the proportion of video, audio, text, still pictures in the pure e-learning system.

The population was made up of 17 masters' students, 15 part two honours students, 60 final year students and 5 lecturers in the department of Computer Science. In this design, a combination of quota and random sampling techniques were used. A total of 50 questionnaires were issued to the participants. This was done as shown in Table 3-1 below.

Table 3-1 Administration of Questionnaires

Group	Calculation	Number of questionnaires issued
Part 2 Honours	$(15/92)*50$	8
Masters	$(17/92)*50$	9
Final year	$(60/92)*50$	33
Lecturers	$(5/92)*50$	3

The sampling approach used here was effective in the sense that it produces a representative sample. Since our population had distinct classes, a representative sample from each class had to be chosen. The proposed approach takes into account the distinct classes in the population. Any other sampling method such as pure random sampling

could not have been ideal because it does not take into account the distinct classes in the population.

3.6. Methodology for Developing the Framework for BMBEL

The Blended Multimedia-Based E-Learning Framework (BMBELF) was developed through analysing frameworks that were developed elsewhere and customising them accordingly to suit learners in developing countries. A questionnaire was developed which was geared to gather data relating to other factors and components which were not outlined in the literature on blended e-learning frameworks. More importantly, the questionnaire also gathered information on the weight of each factor and component on the framework. This is one aspect which makes the proposed framework not only suitable but also unique since the existing frameworks are not weighted. Further, the data gathered using the questionnaire on optimal mix was also incorporated in the framework.

The questionnaire used to gather information had seven questions of which two were on demographic variables and five were on blended e-learning framework. The questionnaires were administered to lecturers and students in the department of computer science. The population was made up of 5 lecturers and 2 assistant lectures and 60 final year students. This population was chosen so as to have a balanced view of both lecturers and students on what the suitable framework should constitute. The final year students were chosen because they are more mature and experienced in using e-learning systems.

Since the population was big, a representative sample was chosen. The researcher wanted a representative small sample of 25 respondents. This was selected by using stratified sampling since there were two distinct categories namely lecturers and students. Here the

population size was 67. In this case, three $\left(\frac{7 \times 25}{67}\right)$ lecturers were chosen randomly and 22 $\left(\frac{60 \times 25}{67}\right)$ students were also chosen randomly. The questionnaires issued to students were issued in class and students were given 30 minutes to complete them. This was done to make sure that all questionnaires were completed and returned. On the other hand lecturers were given questionnaires, completed and returned them as soon as they finished.

The proposed framework combines two types of frameworks namely the verbal and the conceptual framework. A verbal model makes use of English language to describe a model whereas a conceptual shows the relationships that exists between components. A framework that combines the two frameworks is the ideal one because it will be a best of breed framework which maximises the strengths of the two and minimises their weaknesses.

On the whole, the data collected from respondents using all the questionnaires explained in the foregoing were analysed using SPSS. In the analysis the hypotheses stated in chapter one were tested, descriptive statistics were calculated and cross tabulations were performed. More specifically, independent t-tests for equality of means were conducted because the samples being used were independent and also that there were only two groups namely the experimental and the control group.

3.7. Conclusion

Chapter three presented the research methodology wherein it touched on the research tools which were used in this research and also gave the different research designs which were used gather data that was used to answer the different research questions presented

in chapter one. To a greater extent the research design was quantitative in nature and the questionnaire was the research instrument that was mostly used.

CHAPTER FOUR

4. Data Presentation, Analysis and

Discussion

4.1. Introduction

This chapter presents the data that was gathered during the course of the research. The chapter begins by giving the response rate before looking at various research results. In addition to the foregoing, this chapter analyses and discusses the research results. To be more specific this chapter focuses on the data presentation process which involves scanning and sifting the collected data, organising and summarising it. Further the chapter interprets big discoveries of this research and makes intellectual inferences by making reference to concepts and literature.

4.2. Response Rate

Table 4-1 overleaf gives the response rate for the survey. The first column contains the total number of questionnaires that were administered to various respondents. The experimental group consisted of 32 students. A total of 32 questionnaires were issued to this group and 20 were completed and returned and 12 were not returned yielding a response rate of 63 per cent. The similar explanation is true for the control group. The response rate was calculated as follows:

$$\text{Response rate} = \frac{\text{number of questionnaires returned}}{\text{Total number of questionnaires issued}} * 100 \text{ per cent}$$

Table 4-1 Response Rate for Satisfaction

	Experimental Group	Control Group
Number of questionnaires issued	32	61
Number of questionnaires returned	20	51
Number of questionnaires not	12	10
Response Rate (per cent)	63	84

Table 4-2 below shows the response rate of questionnaires that were issued to 92 students and lecturers in the Department of Computer Science as enunciated in chapter three. This data was collected to address research objective 1.4.3 in chapter one. From Table 4-2, it is clear that a total of 50 questionnaires were issued and 37 were completed and returned and 13 were not returned. This implies that the response rate was 74 per cent. The response rate for questionnaires issued to gather information about the framework was 100 percent since 25 questionnaires were issued and all were returned.

Table 4-2 Response Rate for the Mix of Tools in Blended Learning

	Number
Number of questionnaires issued	50
Number of questionnaires returned	37
Number of questionnaires not returned	13
Response Rate (per cent)	74

4.3. Presentation and Analysis of Data Relating to Level of Satisfaction

This section presents data on the level of satisfaction with the blended text-based e-learning approach and the blended multimedia-based e-learning approach. This data addresses research objective 1.4.2 in chapter one. The research data was analysed using SPSS 15 and the results are presented below.

4.3.1. Reliability of the Tool

The reliability of the tool used was measured using Cronobach's Alpha. Using a Cronobach's Alpha Reliability coefficient of 0.6 the tool applied was reliable as five variables have Alpha greater than or equal to 0.6 and only one variable not reliable. The results are show in Table 4-3 overleaf.

Table 4-3 Reliability Statistics

Research instrument	Dimension	Cronback's Alpha	Number of items	Number of cases
Level of satisfaction	Satisfaction with the approach	0.648	4	71
Level of satisfaction	Satisfaction with the platform	0.796	8	71
Optimal mix framework	Optimal mix	0.717	6	37
framework	Blended e-learning factors	0.609	9	25
framework	Blended e- learning components	0.441	7	25
Learning outcomes	Learning outcomes	0.65	2	80

Table 4-4 overleaf shows a t-test for equality of the average level of satisfaction of male and female learners with the blended text-based e-learning approach. The table shows a high significance value of 0.335 and a confidence interval that includes 0. This implies that there was no difference in the level of satisfaction with the blended text-based e-learning approach between male and female learners. This can be explained by the fact that gender does not affect one's level of satisfaction with a teaching and learning approach especially so when dealing with undergraduate students who are still young and single. The same comment is true for a t-test for equality of mean levels of satisfaction between male and female learners with the blended multimedia-e-learning approach.

Table 4-4 overleaf shows the results for the test.

Table 4-4 Independent Samples Test: Satisfaction of Males and Females with the BTBELA and the BMBELA

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
		Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
BTBELA	Equal variances assumed	1.349	.251	-.973	49	.335	.17774	.18266	-.54481	.18933
	Equal variances not assumed			-.819	14.695	.426	.17774	.21710	-.64132	.28584
BMBELA	Equal variances assumed	.659	.428	.348	18	.732	.09091	.26127	-.45799	.63981
	Equal variances not assumed			.403	5.705	.702	.09091	.22560	-.46812	.64994

A one-way analysis of variance (ANOVA) of satisfaction for the control and experimental group was done and the results are presented in Appendix A8. In Appendix A8, there are 13 variables and three of these variables have F-test significance levels above 0.05. This implies that there were no differences between the control and experimental groups. These variables are comment (overall comments made by respondents), age and comfort in using the e-learning system. This can be explained by the fact that comments which respondents in each group made might be independent of the group. On the age variable, it can be said that there was real difference in the ages of respondents in the two groups because the experimental group was made up of part threes and the control group of part twos. This result is valid because in reality there is no meaningful difference in the ages of part twos and threes since they are just separated by one academic year. The last variable of comfort also shows that there is no difference in the level of comfort in using the system, this might have been attributable to common factors affecting both the text-based and multimedia-based systems such accessibility since both were hosted on a local area network. The other common factor might have been limited bandwidth which more or less affected both systems in a similar fashion.

When it comes to other variables in the Appendix A8 with significance values less than 0.05 it can be said that there are significant differences between the experimental and control groups. This result is explained by the fact that the blended e-learning approach brought about more satisfaction to needs of students probably because of the multimedia content which gave students an opportunity to download play video and audio files repeatedly. This opportunity was not available in the text-based approach hence the difference in the levels of satisfaction.

In addition to the above tests, a t-test for the average level of satisfaction with the blended text based e-learning approach and the blended multimedia-based e-learning approach between the control and experimental group was done. Results of the analysis are shown in Table 4-5 below. A low significance value for the t-test of 0.000 and a confidence interval that does not include 0 implies that there was a significant difference in the level of satisfaction with the blended text-based e-learning approach and the blended multimedia-based e-learning approach between the control and experimental group.

Table 4-5 Independent Samples Test: Satisfaction of Males and Females with Both Learning Approaches

		Levene's Test for Equality of Variances		t-test for Equality of Means						
				F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
		Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
AverageSatisfaction	Equal variances assumed	.751	.389	5.244	69	.000	.73075	.13936	.45274	1.00876
	Equal variances not assumed			5.704	41.898	.000	.73075	.12811	.47218	.98931

Statistics in Table 4-5 above were used to test the hypothesis stated in section 1.5 in chapter one. The significance value for the t-test in Table 4-5 of 0.000 which is less than

0.05 implies that there is a significant difference in the means of the two samples. So we reject the null hypothesis which states that there is no difference in the levels of satisfaction of learners needs brought about by blended multimedia-based e-learning and blended text-based learning and accept the alternative hypothesis which states that blended multimedia-based e-learning brings more satisfaction to learners needs than blended text-based e-learning.

This result can be explained by the fact that students were interested in using the multimedia files which were uploaded on the platform. In other words, the video and audio files as well as the problem based learning approach contributed a lot in satisfying the needs of students. The fact that the text-based e-learning approach does not include multimedia files made the learning approach dull and boring and hence resulted in a lower level of satisfaction of learners' needs when compared with the blended multimedia-based e-learning approach.

4.4. Presentation and Analysis of Data Relating to Learning Outcomes

This section presents and analyses data on learning outcomes associated with both the blended multimedia-based e-learning approach and the text-based e-learning approach. The data relates to students' performance in continuous assessments and final examinations. Figure 4-1 overleaf shows the overall marks which were scored by each student in each of the two groups (control and experimental)

Figure 4-1 Line Chart Showing Marks for CT 324 and BSC 126

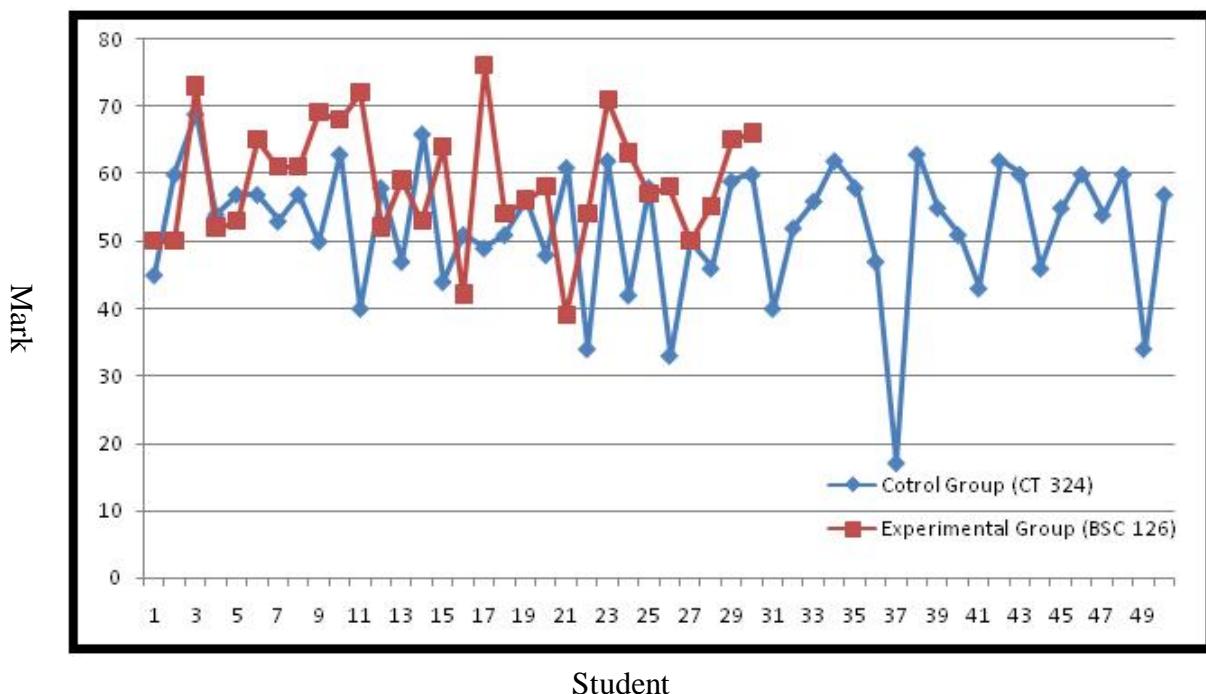


Table 4-6 below shows group statistics for the marks for the two groups namely the experimental group and the control group. From this table it is clear that the mean mark for BSC 126 of 58.87 is higher than a mark for CT 324 of 52.24 implying that the learning outcomes for the experimental group was higher than that of the control group.

Table 4-6 Group Statistics: Marks for BSC 126 and CT 324

	Group	N	Mean	Std. Deviation	Std. Error Mean
Mark	BSC 126	30	58.87	8.966	1.637
	CT 324	50	52.24	9.810	1.387

Table 4-7 overleaf shows information about a t-test of independent samples (CT 324 and BSC 126). A low significance value for the t-test of 0.003 and a confidence interval which excludes 0 mean that there is a significant difference in the learning outcomes of the two samples.

Table 4-7 Independent Samples Test: Mean Marks for BSC 126 and CT 324

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95 per cent Confidence Interval of the Difference	
Mark	Equal variances assumed	.055	.815	3.019	78	.003	6.627	2.195	2.257	10.997
	Equal variances not assumed			3.088	65.589	.003	6.627	2.146	2.342	10.911

The statistics in Table 4-7 were used to test hypothesis stated in section 1.5 in chapter one. The significance value for the t-test of 0.003 which is less than 0.05 and a confidence interval which excludes 0 implies that there is a significant difference in the means of the two samples. So we reject the null hypothesis which states that there is no difference between the learning outcomes produced by blended multimedia-based e-learning and blended text-based e-learning and accept the alternative hypothesis which states that blended multimedia-based e-learning produces superior learning outcomes to those of blended text-based e-learning.

In addition to the above analyses, a one-way ANOVA of marks for the two groups namely the experimental and control group was done. The results are shown in Table 4-8 below. The shows that there is a difference in the marks for these two groups because the significance level of the F-test is 0.03 which is below 0.05.

Table 4-8 ANOVA of Marks for the Experimental and Control Groups

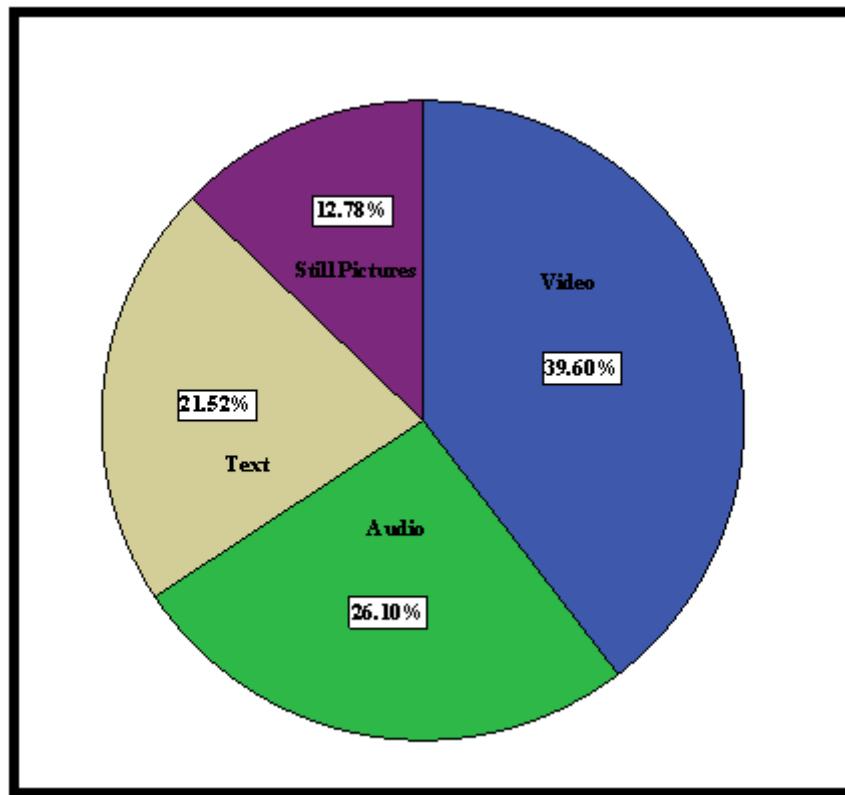
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	823.363	1	823.363	9.114	.003
Within Groups	7046.587	78	90.341		
Total	7869.950	79			

All the above analyses suggest that blended multimedia-based e-learning produces better learning outcomes than those produced by blended text-based e-learning. This might probably be as a result of the fact that the blended multimedia-based e-learning approach stimulated interest in the course which could have translated to better average marks than those for the control group. Further, this result is justified by the fact that downloading and playing video and audio files several times increased the absorption rate which inturn resulted in an increase in the learning outcomes. Also, use of blended e-learning approaches such as problem based learning (PBL) improves the understanding of concepts by students because this is a practical approach to learning which gives students an opportunity to formulate problems and proffer solutions to the problems. Such a practical approach to learning would translate to high performance in tests, assignments and examinations which also translate to improved learning outcomes.

4.5. Optimal Mix of Tools Data

This section presents data on the mix of tools and proportions that make up blended multimedia-based e-learning. The data was collected using a questionnaire from lecturers and students in the Department of Computer Science.

When it comes to the percentage that each multimedia element must constitute, the information is shown in Figure 4-4 overleaf. From that figure, it is evident that still pictures must constitute 12.78 per cent, audio files must constitute 26.10 per cent, video files must constitute 39.60 per cent and text files must constitute 21.52 per cent. An explanation for this grand finding is at the end of this section.

Figure 4-2 Descriptive Statistics: Multimedia Proportions

Here is a further analysis of the optimal mix data by gender. Table 4-9 overleaf shows information about the best mix of tools that form blended e-learning. From this information it is evident that males advocated for a mix of 55.39 per cent against 46.61 per cent in favour of traditional face to face whereas females advocated for a mix of 52.50 per cent against 47.50 per cent in favour of traditional face to face. This can probably be because of the fact that females do not have much time to attend face to face lectures hence are advocating for the reduction of contact time and an increase in the use of the pure e-learning approach which allows them to access learning objects at their own pace with no time constraints associated with face-to-face lectures.

Table 4-9 Descriptive Statistics About Mix by Gender

	What is your gender?	N	Mean	Std. Deviation	Std. Error Mean
What percentage of traditional face to face learning must be included blended e-learning?	Male	28	55.39	19.698	3.723
	Female	8	52.50	18.323	6.478
What percentage of e-learning should be included in blended e-learning?	Male	28	44.61	19.698	3.723
	Female	8	47.50	18.323	6.478

In addition to the above analysis, a t-test for equality of means of optimal mixes for males and females was done. The results are shown in Table 4-10 below it can be concluded that there is no difference in the mix advocated by male and female participants. This conclusion is based on high significant values for the t-test which are above 0.05. This result might appear contradictory to what was presented above but it is clear that the difference in mixes for males and females is so small and only averages were computed but a better statistic would be a t-test.

Table 4-10 Independent Samples Test: Mix for Female and Male Learners

	Levene's Test for Equality of Variances		t-test for Equality of Means							95 per cent Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference				
	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower		
What percentage of traditional face to face learning must be included blended e-learning?	Equal variances assumed	.036	.851	.372	34	.713	2.893	7.787	-12.931	18.717	
	Equal variances not assumed			.387	12.046	.705	2.893	7.471	-13.379	19.165	
What percentage of e-learning should be included in blended e-learning?	Equal variances assumed	.036	.851	-.372	34	.713	-2.893	7.787	-18.717	12.931	
	Equal variances not assumed			-.387	12.046	.705	-2.893	7.471	-19.165	13.379	

Also, a one-way analysis of variance of the optimal mix for seven different age groups was carried out. The results are shown in Table 4-11 below. The seven age groups were 20-25, 26-30, 31-35, 36-40, 41-45, 41-45 and 51-55. The analysis shows that there is no any difference in the optimal mix among these age groups. This can be explained by the fact that all the age groups contain people who are regarded as adults and these have more or less similar needs and hence no difference in the optimal mix that each group proposed.

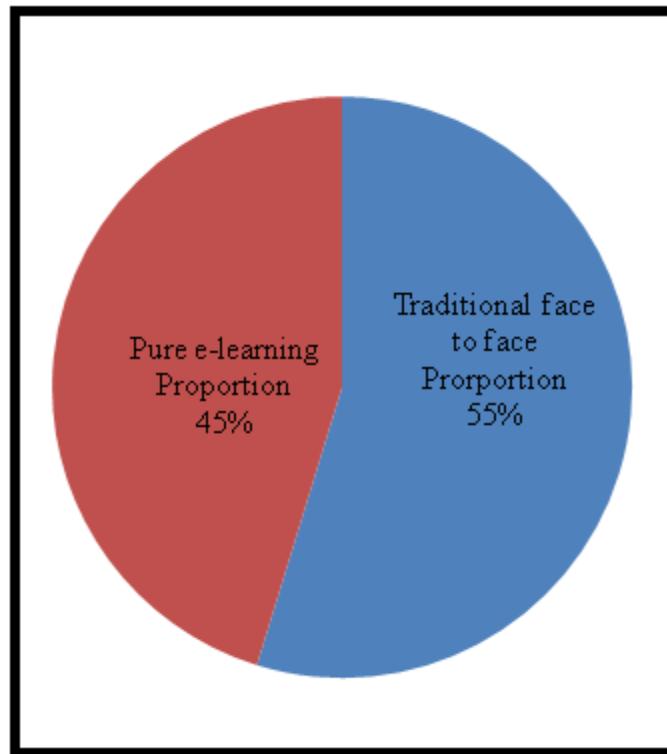
Table 4-11 ANOVA for Optimal Mix for Seven Age Groups

		Sum of Squares	df	Mean Square	F	Sig.
What percentage of traditional face to face learning must be included blended e-learning?	Between Groups	2568.693	9	285.410	.720	.687
	Within Groups	10310.057	26	396.541		
	Total	12878.750	35			
What percentage of e-learning should be included in blended e-learning?	Between Groups	2568.693	9	285.410	.720	.687
	Within Groups	10310.057	26	396.541		
	Total	12878.750	35			
What percentage of multimedia should video constitute?	Between Groups	1236.125	9	137.347	.888	.549
	Within Groups	3868.617	25	154.745		
	Total	5104.743	34			
What percentage of multimedia should audio constitute?	Between Groups	1039.426	9	115.492	1.729	.134
	Within Groups	1669.545	25	66.782		
	Total	2708.971	34			
What percentage of multimedia should text constitute?	Between Groups	1015.852	9	112.872	1.011	.457
	Within Groups	2790.833	25	111.633		
	Total	3806.686	34			
What percentage of multimedia should still pictures constitute?	Between Groups	213.765	9	23.752	.356	.945
	Within Groups	1668.920	25	66.757		
	Total	1882.686	34			
Do you have any comments	Between Groups	4.823	9	.536	.510	.854
	Within Groups	28.366	27	1.051		
	Total	33.189	36			

The overall results relating to the optimal mix of tools in blended multimedia-based e-learning are shown in Figure 4-3 overleaf. From this figure, the optimal mix of tools that go into blended multimedia-based e-learning is 55 per cent against 45 per cent in favour

of the traditional face-to-face approach. This implies that 55 per cent of the content should be delivered through the traditional face-to-face teaching and learning approach whereas 45 per cent should be delivered through the pure e-learning approach.

Figure 4-3 Descriptive Statistics on Mix of Blended E-learning Tools



This result can be due to advancements in multimedia and internet technology which saw many students preferring to learn through an e-learning system than interacting with an instructor during fixed times and fixed venues. So the flexibility associated with pure e-learning might be one reason why students are advocating for a mix wherein 45 per cent of the learning content should be delivered over the e-learning platform. With 45 per cent of the time being reserved for the pure e-learning approach students can afford not to come for lectures on a daily basis since they can just download multimedia files from platform and play them.

The fact that most students now own devices such as palmtops, laptops and cell phones mean that they can easily download multimedia files and play from the e-learning platform and play them on those devices. This might have been one reason why students were advocating that 39 percent of the content should be video and 26 per cent should be audio.

When we look at the other side of the coin that is the proportion of the traditional face-to-face approach, it can be seen that respondents advocated for a proportion of 55 per cent of the content to be taught using this approach. The reason might have been that students are so much used traditional approach to teaching and learning to such an extent that they still want to have more time with lecturers in the class rooms. This might be attributable to the human touch associated with this approach which is not found in the pure e-learning approach.

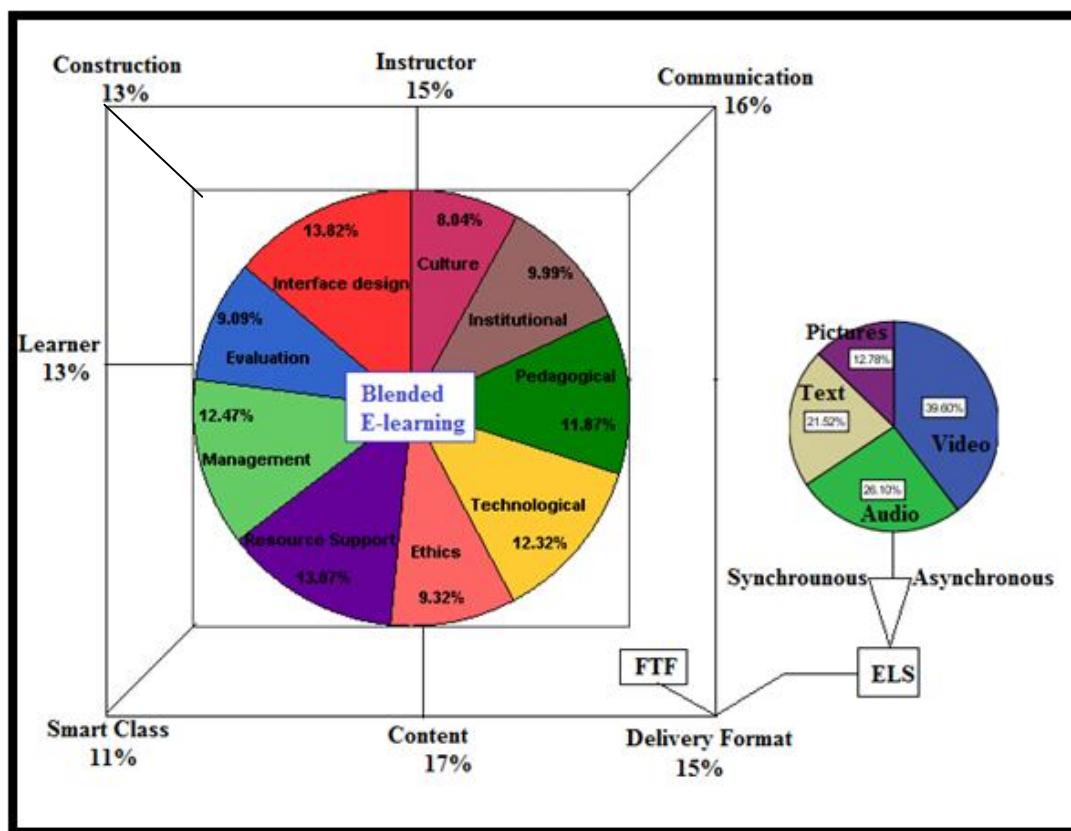
4.6. Framework for Blended Multimedia-Based E-Learning

The framework for blended e-learning presented in Figure 4-4 overleaf serves as a guide to plan, develop, deliver, manage, and evaluate blended learning programs. The framework for blended multimedia e-learning applications includes guidelines for selecting elements of a blended multimedia e-learning arrangement and the sequential ordering of these elements and their weight. The Blended Multimedia-Based E-Learning Framework (BMBELF) was developed by following the approach in section 3.6 in chapter three.

The major components that make up blended e-learning framework were identified as learners, instructors, smart classrooms, content and communication. From the

questionnaires, issues that affect blended e-learning were identified. The issues were, interface design, institutional, resource support, technical, pedagogical, management, cultural, evaluation and ethical. The suitable frame for blended multimedia based e-learning is presented in Figure 4-4 below.

Figure 4-4 Blended Multimedia-Based E-Learning Applications Framework



4.6.1 Blended multimedia learning development steps

The steps which are involved in the development of blended multimedia e-learning are as follows:

1. Identifying all blended e-learning components and attaching a weight on each which shows the value of the component in the blended e-learning approach. Here the course

to be taught using the approach must be determined. Also, the instructor or instructors and the learners to be taught must be identified. From the framework in Figure 4-4, the weight of the instructor component must be 15 per cent and that of the learner must be 13 per cent. The content component is responsible for availing learning material to a learner and the communication component is responsible for offering interpersonal exchange between learners or between learners and instructors must be put in place. The weights of the content and communication components in the framework should be 17 per cent and 16 per cent respectively.

Further, the constructive component is responsible for facilitating and guiding the learner as well as facilitating and guiding cooperative learning activities to actively operate on learning tasks with different degrees of complexity must be established. The weight of this component in the framework must be 13 per cent. The way components can be delivered must be ascertained for instance, the components can be delivered through the traditional face-to-face approach, an exchange media, or is delivered as analogue content by air or via cable or as digital packets over the Internet in a synchronous or asynchronous setting with text, audiovisual or other multimedia elements. The weight of the delivery format component must be 15 per cent and the pure multimedia e-learning aspect of this component must be made up of 39.60 per cent video, 26.50 per cent video, 21.52 per cent text and 12.78 per cent still pictures.

In addition to the foregoing, multimedia equipped classrooms or smart classrooms where the instructors and learners meet must be set up. This component must have a weight of 11 per cent. Also, a network must be established. This allows the instructor to guide the learning process by utilizing the online content where students access the

content via the network. The instructor must develop a LMS responsible for tracking the learning activities and providing the instructor with performance report about the learning process.

2. Naming all factors to be considered when establishing a blended e-learning approach.

The issues are indicated in the framework in the figure 4.4. The weight of each factor in the framework is shown the framework. Here follows an explanation of the factors.

The first factor is **institutional** in nature. Here the instructor must address issues such as organizational, administrative, academic affairs, student services, preparedness of the organization, availability of content and infrastructure. Also, the instructor must assess the feasibility of the institution to offer each learner the learning delivery mode independently as well as in a blended program. Lastly, the instructor must perform a needs analysis so as to understand all learners' needs. The second factor is **pedagogy**.

Here the instructor must conduct content, learner, and learning objectives analyses. Also, the instructor must analyse the design and strategy aspect of e-learning.

The third factor is **technology**. Here the instructor must create a learning environment and identify the tools required to deliver the learning program. Further, the instructor must establish the most suitable learning management system that manages multiple delivery types and the learning content management system that catalogs the actual content for learning program. Also, the instructor must acquire the server that supports the learning program and determine how the server will be accessed. Lastly, the instructor must address issues such as bandwidth and accessibility, security, other hardware, software, and infrastructure.

The fourth factor is **interface design**. Here instructor must critically examine the user interface of each element in the blended learning program. Further, the instructor must analyse the usability of the user interface and ensure that the user interface supports all the elements of the blend. Lastly, the instructor must pay attention to issues like page and site design, content structure, navigation, graphics, and help. The fifth factor is **evaluation**. Here the instructor must evaluate the overall effectiveness of the learning program and must also evaluate the performance of each learner. The sixth factor is **Management**. Here the instructor must pay attention to blended learning administrative issues such as infrastructure and logistics to manage multiple delivery types. Also, the instructor must administer issues such as registration and notification, and scheduling of the different elements of the blend.

The seventh factor is **resource support**. Here the instructor organise resources and make them available for learners. In addition, the instructor must make sure that they are always available either in person, via e-mail, or on a chat system. The eighth factor is **ethics**. Here the instructor must consider issues such as equal opportunity and nationality. The last factor is **culture**. Here the instructor must consider language, social, political, economical and religious issues.

3. Determining the best mix of to be used in presenting the materials content. Here the instructor must determine the course contents to be delivered by pure multimedia-based e-learning and traditional face-to-face approach.
4. Explaining how the contents will be displayed. The instructor with cooperation of pedagogical expert determines how the contents will be displayed, the tools which

will be used and the suitable content format, for example using PDF, Presentation, Text, HTTP, Wiki and XML.

5. Deciding the course activities: the lecturer with cooperation of pedagogical expert decides the suitable course activities, for example assignments, homework, chats, glossaries and quizzes.
6. Developing and designing. The lecturer develops the selected contents and activities and the multimedia technician designs the multimedia then put all in the target blended e-learning course.
7. Evaluating. The instructor insures that the blended e-learning course fits quality assurance procedures.
8. Updating. The lecturer with cooperation of the programmer makes the final modification upon the evaluation notes.
9. Allowing the blended e-learning course access.

In addition to the above deliberations, one-way analyses of variances were also carried out to determine whether there were differences in ranking of factors and components among male and female respondents and also among students and lecturers. The results are shown in Appendix A. A one-way ANOVA of factors and components of blended e-learning for both males and females indicate that there are no differences between the two groups since the significance value of the F-test is greater than 0.05. The same can be said of the ANOVA of factors and components of blended e-learning for students and

lecturers. The reason for this might be that since the background of respondents was more or less the same hence no differences in the framework that they advocated for.

4.7. Conclusion

Chapter four presented, analysed and discussed research findings. The major findings were that blended multimedia based e-learning improves learning outcomes and brings maximum satisfaction to learners' needs. This conclusion was reached after a comparison of the levels of satisfaction and learning outcomes of both the control and experimental groups. In addition, it was also found that the optimal mix of tools is 55 per cent against 45 per cent in favour of traditional face-to-face meaning that 55 per cent of content should be delivered via the traditional face-to-face approach and the rest must then be delivered using the pure-learning approach. Lastly a suitable framework for blended multimedia-based e-learning applications was presented. This is the kind of framework that best suits the learning needs of learners in developing countries and their associated learning environments.

CHAPTER FIVE

5. Conclusions and Recommendations

5.1. Introduction

Chapter five concludes this research work. Here a summary of major research findings is presented and recommendations are also made to course instructors and academic institutions. The findings are made with respect to the research objectives stated in chapter one. Also, this chapter outlines areas of further research.

5.2. Conclusions

This research focused on a suitable framework for blended multimedia e-learning applications. More specifically the research was so much about the impact that blended multimedia e-learning has on learning outcomes and the level of satisfaction of learners needs. In addition the research also touched on the optimal mix of tools that go into blended e-learning. The paper began by presenting the problem statement, research objectives, hypothesis and other issues included in chapter one. Further, the research gave an outline of the literature on blended e-learning and in chapter three the research approach was presented. Lastly, chapter four presented research findings, analysed and discussed them.

The major research conclusions were:

- i. Blended multimedia e-learning improves learning outcomes of learning in developing country institutions like the University of Zimbabwe.
- ii. Blended multimedia e-learning brings maximum satisfaction to the learners' needs of students in developing country institutions such as the University of Zimbabwe.
- iii. The optimal mix of blended learning is 55 per cent against 45 per cent in favour of traditional face to face.
- iv. The framework for blended multimedia e-learning is presented in chapter four.

5.3. Recommendations

In light of the foregoing conclusions, it is recommended that:

- i. The University of Zimbabwe authorities, academics, deans of faculties and chairpersons of departments must adopt the blended multimedia-based e-learning approach because it has been found to improve the learning outcomes of students and also bring maximum satisfaction to learners needs. Here course instructors are recommended to use a blended e-learning mix close to the 55 per cent against 45 per cent in favour of traditional face to face. It is recommended that 45 per cent of the contact time and content should be reserved for the pure multi-media-based e-learning approach and rest should be left for the traditional face-to-face approach.

- ii. The other recommendation is that instructors should use the blended multimedia-based e-learning framework presented in chapter four since this framework was found to be the most suitable framework for learning intuitions in developing countries.

5.4. Areas of Further Research

Since this research was only carried out using the asynchronous multimedia-based approach, further research can also be pursued on the same area which must focus on the synchronous multimedia-based approach wherein learning objects are streamed in real time. Further, this research focused more on students, as such further research can also be carried out where in the focus will be on the impact that blended multimedia e-learning has on the level of satisfaction of instructors. Lastly, due to advancements in mobile technology, further research should be done to determine the impact of mobile e-learning on learning outcomes and level of satisfaction.

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GLOSSARY

Asynchronous e-learning

Asynchronous learning refers to communication between participants that does not occur in real-time. Learning content is served from a Web Server and delivered on demand to the learners' workstation (Itmazi and Tmeizeh, 2008).

Blended e-learning

Blended learning refers to learning that is facilitated by the effective combination of different modes of delivery, models of teaching and styles of learning, and founded on transparent communication amongst all parties involved with a course (Heinze and Procter 2004).

E-learning

E-learning refers to a concept derived from the use of information and communication technologies to revise and transform traditional teaching and learning models and practices (Evelyn Kigozi Kahiigi *et al*, 2008).

Framework

A framework creates a broad vocabulary used to model recurring concepts and integration environments and is equivalent to the concept of a pattern in the software community (Scott Wilson, Kerry Blinco and Daniel Rehak, 2004).

Multimedia

Multimedia is “the combination of various digital media types, such as text, images, sound, and video, into an integrated multisensory interactive application or presentation to convey a message or information to an audience” (Neo, M and K. Neo, 2001).

Multimedia refers to computer-mediated information that is presented concurrently in more than one medium. It consists of some, but not necessarily all, of the following elements: text; still graphic images; motion graphics; animations; hypermedia; photographs; video; and audio, i.e., sounds, music, and narration (Kleen & Shell, 1994; Najjar, 1996; Tannenbaum, 1998).

Synchronous e-learning

Synchronous e-learning means that all learners and instructors are logged on at the same time and communicate directly and virtually with each other (Itmazi and Tmeizeh, 2008).

Traditional Learning

Traditional Learning refers to face-to-face sessions, through which the instructor delivers courseware to learners in the same place at the same time (Evelyn Kigozi Kahiigi etal, 2008).

APPENDICES

Appendix A

A1: Descriptive Group Statistics on Overall Level of Satisfaction

	Group	N	Mean	Std. Deviation	Std. Error Mean
AverageSatsfaction	Text-Based Approach	51	2.6898	.55303	.07744
	Multimedia-Based Approach	20	1.9591	.45643	.10206

A2: ANOVA for Blended-E-Learning Factors for Males and Females

		Sum of Squares	df	Mean Square	F	Sig.
Other Factors	Between Groups	.014	1	.014	.175	.679
	Within Groups	1.826	23	.079		
	Total	1.840	24			
Interface design	Between Groups	2.825	1	2.825	.575	.456
	Within Groups	112.935	23	4.910		
	Total	115.760	24			
Evaluation	Between Groups	.251	1	.251	.048	.829
	Within Groups	121.109	23	5.266		
	Total	121.360	24			
Management	Between Groups	.890	1	.890	.192	.666
	Within Groups	106.870	23	4.647		
	Total	107.760	24			
Resource Support	Between Groups	.003	1	.003	.001	.979
	Within Groups	112.957	23	4.911		
	Total	112.960	24			
Ethics	Between Groups	19.047	1	19.047	2.519	.126
	Within Groups	173.913	23	7.561		
	Total	192.960	24			
Technological	Between Groups	.421	1	.421	.062	.805
	Within Groups	155.739	23	6.771		
	Total	156.160	24			
Pedagogical	Between Groups	6.136	1	6.136	2.161	.155
	Within Groups	65.304	23	2.839		
	Total	71.440	24			
Institutional	Between Groups	.070	1	.070	.017	.898
	Within Groups	97.370	23	4.233		
	Total	97.440	24			
Culture	Between Groups	23.388	1	23.388	2.566	.123
	Within Groups	209.652	23	9.115		
	Total	233.040	24			

A3: ANOVA for Blended E-Leaning Factors for Students and Lecturers

		Sum of Squares	df	Mean Square	F	Sig.
Other Factors	Between Groups	.219	1	.219	3.104	.091
	Within Groups	1.621	23	.070		
	Total	1.840	24			
Interface design	Between Groups	1.639	1	1.639	.330	.571
	Within Groups	114.121	23	4.962		
	Total	115.760	24			
Evaluation	Between Groups	.830	1	.830	.158	.694
	Within Groups	120.530	23	5.240		
	Total	121.360	24			
Management	Between Groups	.442	1	.442	.095	.761
	Within Groups	107.318	23	4.666		
	Total	107.760	24			
Resource Support	Between Groups	6.430	1	6.430	1.388	.251
	Within Groups	106.530	23	4.632		
	Total	112.960	24			
Ethics	Between Groups	19.202	1	19.202	2.542	.125
	Within Groups	173.758	23	7.555		
	Total	192.960	24			
Technological	Between Groups	10.721	1	10.721	1.695	.206
	Within Groups	145.439	23	6.323		
	Total	156.160	24			
Pedagogical	Between Groups	3.501	1	3.501	1.185	.288
	Within Groups	67.939	23	2.954		
	Total	71.440	24			
Institutional	Between Groups	.001	1	.001	.000	.991
	Within Groups	97.439	23	4.236		
	Total	97.440	24			
Culture	Between Groups	1.767	1	1.767	.176	.679
	Within Groups	231.273	23	10.055		
	Total	233.040	24			

A4: ANOVA for Blended E-learning Components for Males and Females

		Sum of Squares	df	Mean Square	F	Sig.
Communication	Between Groups	2.004	1	2.004	.580	.454
	Within Groups	75.955	22	3.452		
	Total	77.958	23			
Smart Class	Between Groups	6.061	1	6.061	1.601	.219
	Within Groups	83.273	22	3.785		
	Total	89.333	23			
Constructive Component	Between Groups	.015	1	.015	.003	.956
	Within Groups	107.818	22	4.901		
	Total	107.833	23			
Delivery Format	Between Groups	.004	1	.004	.001	.970
	Within Groups	58.955	22	2.680		
	Total	58.958	23			
Instructor	Between Groups	2.004	1	2.004	.558	.463
	Within Groups	78.955	22	3.589		
	Total	80.958	23			
Learner	Between Groups	.379	1	.379	.093	.763
	Within Groups	89.455	22	4.066		
	Total	89.833	23			
Content	Between Groups	.136	1	.136	.047	.831
	Within Groups	64.364	22	2.926		
	Total	64.500	23			
Comment	Between Groups	.004	1	.004	.087	.770
	Within Groups	.955	22	.043		
	Total	.958	23			

A5: ANOVA of Blended E-learning Components for Students and Lectures

		Sum of Squares	df	Mean Square	F	Sig.
Communication	Between Groups	4.339	1	4.339	1.297	.267
	Within Groups	73.619	22	3.346		
	Total	77.958	23			
Smart Class	Between Groups	9.524	1	9.524	2.625	.119
	Within Groups	79.810	22	3.628		
	Total	89.333	23			
Constructive Component	Between Groups	1.167	1	1.167	.241	.629
	Within Groups	106.667	22	4.848		
	Total	107.833	23			
Delivery Format	Between Groups	.006	1	.006	.002	.963
	Within Groups	58.952	22	2.680		
	Total	58.958	23			
Instructor	Between Groups	5.720	1	5.720	1.673	.209
	Within Groups	75.238	22	3.420		
	Total	80.958	23			
Learner	Between Groups	.214	1	.214	.053	.821
	Within Groups	89.619	22	4.074		
	Total	89.833	23			
Content	Between Groups	2.881	1	2.881	1.029	.322
	Within Groups	61.619	22	2.801		
	Total	64.500	23			
Comment	Between Groups	.006	1	.006	.138	.714
	Within Groups	.952	22	.043		
	Total	.958	23			

A6: Independent Samples Test for CT 324 and BSC 126

		Levene's Test for Equality of		t-test for Equality of Means							
		F	Sig.	t	df	Sig. (2-tailed)	Mean Differ	Std. Error	95 per cent		
		Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	
Being glad to take another course via the approach to	Equal variances	3.2269	0.0768	3.0850	69.00	0.0029	0.8510	0.2758	0.3007	1.4013	
	Equal variances			3.6700	52.2163	0.0006	0.8510	0.2319	0.3857	1.3162	
Level of disappointment disappointed with e-learning	Equal variances	0.0448	0.8330	-0.229	69.0000	0.8195	-0.081	0.3552	-0.7900	0.6272	
	Equal variances			-0.233	36.0452	0.8171	0.081	0.3492	-0.7895	0.6268	
Extent to which approach served learning needs of	Equal variances	0.9965	0.3216	3.0195	69.0000	0.0035	0.7206	0.2386	0.2445	1.1967	
	Equal variances			3.2736	41.5746	0.0021	0.7206	0.2201	0.2762	1.1649	
Frequency of use of e-learning platform?	Equal variances	21.9155	0.0000	3.0036	69.0000	0.0037	0.5010	0.1668	0.1682	0.8337	
	Equal variances			3.7956	60.2475	0.0003	0.5010	0.1320	0.2370	0.7650	
Year of Study?	Equal variances	7.1622	0.0093	2.2391	69.0000	0.0284	0.4588	0.2049	0.0500	0.8676	
	Equal variances			2.7886	58.3134	0.0071	0.4588	0.1645	0.1295	0.7881	
Age?	Equal variances	2.2827	0.1354	0.7400	69.0000	0.4618	0.2941	0.3975	0.4988	1.0870	
	Equal variances			0.7684	37.6841	0.4470	0.2941	0.3828	0.4810	1.0692	
Gender?	Equal variances	0.4230	0.5176	0.3159	69.0000	0.7531	0.0353	0.1117	0.1876	0.2582	
	Equal variances			0.3219	36.1966	0.7494	0.0353	0.1096	0.1870	0.2576	
Liked the approach to learning?	Equal variances	0.4485	0.5053	3.5066	69.0000	0.0008	0.8529	0.2432	0.3677	1.3382	
	Equal variances			3.9081	44.4130	0.0003	0.8529	0.2182	0.4132	1.2927	
Enjoyed reading the content from the e-learning system	Equal variances	3.3444	0.0718	3.9497	69.0000	0.0002	1.0578	0.2678	0.5235	1.5922	
	Equal variances			4.6209	50.0876	0.0000	1.0578	0.2289	0.5981	1.5176	
Comfort in using the e-learning system?	Equal variances	1.9771	0.1642	0.8718	69.0000	0.3863	0.2529	0.2901	-0.3259	0.8318	
	Equal variances			0.8020	29.7481	0.4289	0.2529	0.3154	0.3914	0.8972	
Had time to explore the e-learning platform?	Equal variances	4.0619	0.0478	3.4286	69.0000	0.0010	1.0471	0.3054	0.4378	1.6563	
	Equal variances			3.9747	48.9525	0.0002	1.0471	0.2634	0.5177	1.5765	
Enjoyed using the platform?	Equal variances	6.1908	0.0153	4.5333	69.0000	0.0000	1.1775	0.2597	0.6593	1.6956	
	Equal variances			5.7599	60.9526	0.0000	1.1775	0.2044	0.7687	1.5862	
E-learning platform attractiveness?	Equal variances	4.8039	0.0318	3.2908	69.0000	0.0016	0.9667	0.2937	0.3807	1.5527	
	Equal variances			4.0710	57.4114	0.0001	0.9667	0.2375	0.4912	1.4421	
Affordability of the missing face-to-face lectures because	Equal variances	0.0922	0.7624	2.1131	69.0000	0.0382	0.6922	0.3276	0.0387	1.3456	
	Equal variances			2.0932	34.1316	0.0438	0.6922	0.3307	0.0203	1.3641	
Comment	Equal variances	1.2361	0.2701	-1.209	69.0000	0.2305	-0.343	0.2836	-0.9090	0.2227	
	Equal variances			-1.347	44.3332	0.1847	-0.343	0.2547	-0.8563	0.1700	

A7: Descriptive Group Statistics on Levels of Satisfaction

	Group	N	Mean	Std. Deviation	Std. Error Mean
Frequency of use of e-learning platform?	Text-Based Approach	51	2.45	.702	.098
	Multimedia-Based Approach	20	1.95	.394	.088
Extent to which approach served learning needs of learners?	Text-Based Approach	51	2.47	.946	.132
	Multimedia-Based Approach	20	1.75	.786	.176
Level of disappointment disappointed with e-learning platform	Text-Based Approach	51	3.57	1.360	.190
	Multimedia-Based Approach	20	3.65	1.309	.293
Being glad to take another course via the approach to learning?	Text-Based Approach	51	2.45	1.137	.159
	Multimedia-Based Approach	20	1.60	.754	.169
Liked the approach to learning?	Text-Based Approach	51	2.35	.976	.137
	Multimedia-Based Approach	20	1.50	.761	.170
Enjoyed reading the content from the e-learning system to improve learning?	Text-Based Approach	51	2.61	1.097	.154
	Multimedia-Based Approach	20	1.55	.759	.170
Comfort in using the e-learning system?	Text-Based Approach	51	2.35	1.036	.145
	Multimedia-Based Approach	20	2.10	1.252	.280
Had time to explore the e-learning platform?	Text-Based Approach	51	2.65	1.246	.174
	Multimedia-Based Approach	20	1.60	.883	.197
Enjoyed using the platform?	Text-Based Approach	51	2.63	1.095	.153
	Multimedia-Based Approach	20	1.45	.605	.135
E-learning platform attractiveness?	Text-Based Approach	51	2.67	1.227	.172
	Multimedia-Based Approach	20	1.70	.733	.164
Affordability of the missing face-to-face lectures because of the e-learning system?	Text-Based Approach	51	3.39	1.234	.173
	Multimedia-Based Approach	20	2.70	1.261	.282
Comment	Text-Based Approach	51	3.16	1.138	.159
	Multimedia-Based Approach	20	3.50	.889	.199

A8: ANOVA of Level of Satisfaction for the Control and Experimental Group

		Sum of Squares	df	Mean Square	F	Sig.
Age?	Between Groups	1.243	1	1.243	.548	.462
	Within Groups	156.588	69	2.269		
	Total	157.831	70			
Year of Study?	Between Groups	3.024	1	3.024	5.014	.028
	Within Groups	41.624	69	.603		
	Total	44.648	70			
Frequency of use of e-learning platform?	Between Groups	3.606	1	3.606	9.021	.004
	Within Groups	27.577	69	.400		
	Total	31.183	70			
Extent to which approach served learning needs of learners?	Between Groups	7.460	1	7.460	9.117	.004
	Within Groups	56.456	69	.818		
	Total	63.915	70			
Being glad to take another course via the approach to learning?	Between Groups	10.404	1	10.404	9.517	.003
	Within Groups	75.427	69	1.093		
	Total	85.831	70			
Liked the approach to learning?	Between Groups	10.452	1	10.452	12.297	.001
	Within Groups	58.647	69	.850		
	Total	69.099	70			
Enjoyed reading the content from the e-learning system to improve learning?	Between Groups	16.076	1	16.076	15.600	.000
	Within Groups	71.107	69	1.031		
	Total	87.183	70			
Comfort in using the e-learning system?	Between Groups	.919	1	.919	.760	.386
	Within Groups	83.447	69	1.209		
	Total	84.366	70			
Had time to explore the e-learning platform?	Between Groups	15.750	1	15.750	11.755	.001
	Within Groups	92.447	69	1.340		
	Total	108.197	70			
Enjoyed using the platform?	Between Groups	19.917	1	19.917	20.551	.000
	Within Groups	66.872	69	.969		
	Total	86.789	70			
E-learning platform attractiveness?	Between Groups	13.424	1	13.424	10.830	.002
	Within Groups	85.533	69	1.240		
	Total	98.958	70			
Affordability of the missing face-to-face lectures because of the e-learning system?	Between Groups	6.883	1	6.883	4.465	.038
	Within Groups	106.357	69	1.541		
	Total	113.239	70			
Comment	Between Groups	1.692	1	1.692	1.464	.230
	Within Groups	79.745	69	1.156		
	Total	81.437	70			

Appendix B

B1: Satisfaction with the Blended Text-Based Approach Questionnaire

This questionnaire is based on your experience with the blended text-based e-learning learning methodology which is combination of traditional face-to-face learning and the text based e-learning platform that you have been using. It is geared to gather information about your level of satisfaction with the blended text-based approach to learning.

SECTION A: DEMOGRAPHICS

1. What is your gender? (*Tick one box below*)

Male Female

2. How old are you?

3. Year of study (*Tick one box below*)

Part One Part two Part Three Part Four

SECTION B: SATISFACTION

4. How often do you use the text-based e-learning platform? (*Tick one box below*)

Daily 2 to 3 times per week weekly monthly

5. I felt that the text-based e-learning system served my learning needs well. (*Tick one box below*)

Strongly Agree

Agree

Uncertain

Strongly Disagree

Disagree

6. I was very disappointed with the way the text-based blended e-learning system worked out. (*Tick one box below*)

Strongly Agree

Agree

Uncertain

Strongly Disagree

Disagree

7. If I had the opportunity to take another course via the text-based blended e-learning system, I would gladly do so. (*Tick one box below*)

Strongly Agree

Agree

Uncertain

Strongly Disagree

Disagree

8. I liked the text-based blended e-learning approach to learning. (*Tick one box below*)

Strongly Agree

Agree

Uncertain

Strongly Disagree

Disagree

9. I enjoyed reading the text from the text based e-learning system to improve my learning. (*Tick one box below*)

Strongly Agree

Agree

Uncertain

Strongly Disagree

Disagree

10. I felt comfortable with using the text based e-learning system. (*Tick one box below*)

Strongly Agree

Agree

Uncertain

Strongly Disagree

Disagree

11. I managed to have time to explore the text based e-learning platform. (*Tick one box below*)

Strongly Agree

Agree

Uncertain

Strongly Disagree

Disagree

12. I enjoyed using the text based e-learning platform. (*Tick one box below*)

Strongly Agree

Agree

Uncertain

Strongly Disagree

Disagree

13. I found the text based e-learning platform attractive. (*Tick one box below*)

Strongly Agree

Agree

Uncertain

Strongly Disagree

Disagree

14. With the text based e-learning system I can afford to miss face-to-face lectures (*Tick one box below*)

Strongly Agree

Agree	<input type="checkbox"/>
Uncertain	<input type="checkbox"/>
Strongly Disagree	<input type="checkbox"/>
Disagree	<input type="checkbox"/>

15. Do have any other comments?

.....

B2: Questionnaire on satisfaction with the blended multimedia-based approach

This questionnaire is based on your experience with the blended multimedia based e-learning learning methodology which is combination of traditional face-to-face learning and the multimedia e-learning platform that you have been using. It is geared to gather information about your level of satisfaction with the blended multimedia-based approach to learning.

SECTION A: DEMOGRAPHICS

1. What is your gender? (*Tick one box below*)

Male Female

2. How old are you?

3. Year of study (*Tick one box below*)

Part two Part Three

SECTION B: SATISFACTION WITH THE MULTIMEDIA-BASED BLENDED E-LEARNING SYSTEM

4 How often do you use the multimedia-based blended e-learning platform? (*Tick one box below*)

Daily 2 to 3 times per week weekly monthly

5. I felt that the multimedia-based blended e-learning system served my learning needs well. (*Tick one box below*)

Strongly Agree

Agree

Uncertain

Strongly Disagree

Disagree

6. I was very disappointed with the way the multimedia-based blended e-learning system worked out. (*Tick one box below*)

Strongly Agree

Agree

Uncertain

Strongly Disagree

Disagree

7. If I had the opportunity to take another course via the multimedia-based blended e-learning system, I would gladly do so. (*Tick one box below*)

Strongly Agree

Agree

Uncertain

Strongly Disagree

Disagree

8. I liked the multimedia-based blended e-learning approach to learning. (*Tick one box below*)

Strongly Agree

Agree

Uncertain

Strongly Disagree

Disagree

9. I enjoyed reading, listening to and watching the files from the multimedia-based e-learning system to improve my learning. (*Tick one box below*)

Strongly Agree	<input type="checkbox"/>
Agree	<input type="checkbox"/>
Uncertain	<input type="checkbox"/>
Strongly Disagree	<input type="checkbox"/>
Disagree	<input type="checkbox"/>

10. I felt comfortable with using the multimedia-based e-learning system. (*Tick one box*)

Strongly Agree	<input type="checkbox"/>
Agree	<input type="checkbox"/>
Uncertain	<input type="checkbox"/>
Strongly Disagree	<input type="checkbox"/>
Disagree	<input type="checkbox"/>

11. I managed to have time to explore the multimedia-based e-learning platform. (*Tick one box below*)

Strongly Agree	<input type="checkbox"/>
Agree	<input type="checkbox"/>
Uncertain	<input type="checkbox"/>
Strongly Disagree	<input type="checkbox"/>
Disagree	<input type="checkbox"/>

12. I enjoyed using the multimedia-based e-learning platform. (*Tick one box below*)

Strongly Agree	<input type="checkbox"/>
Agree	<input type="checkbox"/>
Uncertain	<input type="checkbox"/>
Strongly Disagree	<input type="checkbox"/>
Disagree	<input type="checkbox"/>

13. I found the multimedia-based e-learning platform attractive. (*Tick one box below*)

Strongly Agree	<input type="checkbox"/>
Agree	<input type="checkbox"/>
Uncertain	<input type="checkbox"/>
Strongly Disagree	<input type="checkbox"/>
Disagree	<input type="checkbox"/>

14. With the multimedia-based e-learning system I can afford to miss face-to-face lectures (*Tick one box below*)

Strongly Agree	<input type="checkbox"/>
Agree	<input type="checkbox"/>
Uncertain	<input type="checkbox"/>
Strongly Disagree	<input type="checkbox"/>
Disagree	<input type="checkbox"/>

15. Do have any other comments?

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B3: Questionnaire on the Optimal Mix of Tools

This questionnaire is based on the blended multimedia based e-learning learning methodology which is combination of traditional face-to-face learning and the multimedia e-learning platform. It is geared to gather data about your opinion on the optimal mix learning tools.

SECTION A: DEMOGRAPHICS

1. What is your gender? (*Tick one box below*)

Male Female

2. How old are you?

3. Are you a student or a Lecturer? (*Tick one box below*)

Student Lecturer

4. If you are a student, what is your year of study (*Tick one box below*)

Part One

Part two

Part Three

Part Four

Masters Student

SECTION B: OPTIMAL MIX OF LEARNING TOOLS

For question 5 and 6, give a percentage between 0 and 100 inclusive and the sum of the answers for the two questions must add up to 100 per cent

5. What percentage of traditional face-to-face learning should be included in blended e-learning?

6. What percentage of e-learning should be included in blended e-learning?

7. What percentage of multimedia should audio, text, still picture and video constitute

Video Audio Text Still pictures.

8. Do have any other comments?

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B4: Questionnaire on the Framework for Blended Multimedia Based E-learning

This questionnaire is based on the blended multimedia based e-learning approach which is a combination of the traditional face-to-face learning approach and the multimedia based e-learning platform. It is geared to gather information about components of the blended multimedia-based e-learning approach and the factors that affect the same approach.

SECTION A: DEMOGRAPHICS

1. What is your gender? (*Tick one box below*)

Male Female

2. What is your designation?

Student Lecturer

SECTION B: BLENDED MULTIMEDIA-BASED E-LEARNING FRAMEWORK

Below are some of the factors that affect the blended multimedia e-learning approach.

- i. **Institutional factors** – include organisational, administrative, academic affairs, student services, preparedness of the institution, availability of content and infrastructure.
- ii. **Pedagogical factors**- include analysis of content, learner, and learning objectives and design and strategy of e-learning.
- iii. **Technological factors** - include suitable learning management system, server that supports the learning program, server access, bandwidth and accessibility, security, other hardware, software and infrastructure.
- iv. **Interface design factors** – include interface of each element in the blended learning program, page and site design, content structure, navigation, graphics, and help.
- v. **Evaluation factors**- include evaluation of the overall effectiveness of the learning program and performance of each leaner.
- vi. **Management factors**- include infrastructure and logistics to manage multiple delivery types, registration and notification and scheduling of the different elements of the blend.
- vii. **Resource support**- includes evaluation of the overall effectiveness of the learning program and performance of each learner.

- viii. **Ethical factors-** include equal opportunity, nationality, etc
- ix. **Cultural factors –** include language, social, political, economical and religious issues.
3. List (if any) other factors that you think affect blended multimedia-based e-learning which have not been included in the above list.
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4. On a scale of 1-9 (1 means most important and 9 means least important) rank the factors that affect blended e-learning in order of importance.

Factor	Rank
Interface design	
Evaluation	
Management	
Resource support	
Ethics	
Technological	
Pedagogical	
Institutional	
Culture	

Below are some of the components that make up blended multimedia-based e-learning.

- i. **Content component-** avails learning material to the learner
 - ii. **Learner component-** one to be taught
 - iii. **Instructor component-** one to teach the course
 - iv. **Delivery format component-** face-to-face and multimedia-based e-learning
 - v. **Communication component-** responsible for offering interpersonal exchange between learners and instructors.
 - vi. **Smart class –** multimedia enabled classroom
 - vii. **Constructive component –** responsible for facilitating and guiding the learner as well as facilitating and guiding cooperative learning activities.
5. List (if any) other components that you think must be included in blended multimedia based e-learning framework which have not been included in the above list
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6. On a scale of 1-7 (1 means least important and 7 means most important) rank the components of the blended e-learning framework in order of importance.

Component	Rank
Communication	
Smart class	
Constructive component	
Delivery format	
Instructor	
Learner	
Content	

7. Do you have any other comments?

.....

B5: Questionnaire on satisfaction with the blended multimedia-based approach

This questionnaire is based on your experience with the blended multimedia based e-learning learning methodology which is combination of traditional face-to-face learning and the multimedia e-learning platform that you have been using. It is geared to gather information about your level of satisfaction with the blended multimedia-based approach to learning.

SECTION A: DEMOGRAPHICS

1. What is your gender? (*Tick one box below*)

Male Female

2. How old are you?

3. Year of study (*Tick one box below*)

Part two Part Three

SECTION B: SATISFACTION WITH THE MULTIMEDIA-BASED BLENDED E-LEARNING SYSTEM

4. How often do you use the multimedia-based blended e-learning platform? (*Tick one box below*)

Daily 2 to 3 times per week weekly monthly

5. I felt that the multimedia-based blended e-learning system served my learning needs well. (*Tick one box below*)

Strongly Agree

Agree

Uncertain

Strongly Disagree

Disagree

6. I was very disappointed with the way the multimedia-based blended e-learning system worked out. (*Tick one box below*)

Strongly Agree

Agree

Uncertain

Strongly Disagree

Disagree

7. If I had the opportunity to take another course via the multimedia-based blended e-learning system, I would gladly do so. (*Tick one box below*)

Strongly Agree

Agree

Uncertain

Strongly Disagree

Disagree

8. I liked the multimedia-based blended e-learning approach to learning. (*Tick one box below*)

Strongly Agree

Agree

Uncertain

Strongly Disagree

Disagree

9. I enjoyed reading, listening to and watching the files from the multimedia-based e-learning system to improve my learning. (*Tick one box below*)

Strongly Agree

Agree

Uncertain

Strongly Disagree

Disagree

10. I felt comfortable with using the multimedia-based e-learning system. (*Tick one box*)

Strongly Agree

Agree

Uncertain

Strongly Disagree

Disagree

11. I managed to have time to explore the multimedia-based e-learning platform. (*Tick one box below*)

Strongly Agree

Agree

Uncertain

Strongly Disagree

Disagree

12. I enjoyed using the multimedia-based e-learning platform. (*Tick one box below*)

Strongly Agree	<input type="checkbox"/>
Agree	<input type="checkbox"/>
Uncertain	<input type="checkbox"/>
Strongly Disagree	<input type="checkbox"/>
Disagree	<input type="checkbox"/>

13. I found the multimedia-based e-learning platform attractive. (*Tick one box below*)

Strongly Agree	<input type="checkbox"/>
Agree	<input type="checkbox"/>
Uncertain	<input type="checkbox"/>
Strongly Disagree	<input type="checkbox"/>
Disagree	<input type="checkbox"/>

14. With the multimedia-based e-learning system I can afford to miss face-to-face lectures (*Tick one box below*)

Strongly Agree	<input type="checkbox"/>
Agree	<input type="checkbox"/>
Uncertain	<input type="checkbox"/>
Strongly Disagree	<input type="checkbox"/>
Disagree	<input type="checkbox"/>

15. Do have any other comments?

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