

A Model for an ePortfolio-based Reflective Feedback: Case Study of eLearning in Developing Countries

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Dedication

*This Thesis is dedicated
To
My wife Aida,
My daughters Luladay and Hermella
and
all course participants*

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Acronyms

ASELEH	Association to Support eLearning and eHealthcare in DCs
AVU	African Virtual University
BeP	Basic ePortfolio
CSF	Critical success factors
DCs	Developing Countries
DSL	digital subscriber line
G-eL	Group-based eLearning
ICT	information and communication technology
IMS	Instructional Management System
ISDN	integrated services digital network
ISE	Internet Self-Efficacy
LIP	Learner Information Package
LMS	Learning Management System (Platform)
LTSC	Learning Technology Standards Committee
LTK	Learning Theories Knowledgebase
MDGs	Millennium Development Goals
NGO	nongovernmental organization
S&T	Science and technology
SMS	Short Message System
SPIDER	The Swedish Program for ICT in Developing Regions
SSA	Sub-Saharan Africa
TA	Access to technological Infrastructure
TU	Use of technological Infrastructure
VoIP	Voice over Internet Protocol
VSAT	very small aperture terminal
WDI	World Development Indicators
XML	Extensible Mark-up Language

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Abstract

For the last few decades, information and communication technologies (ICT) in education (referred as eLearning) have been increasingly used as tools to improve learning and as field of studies by inundating all the facets of education and training without leaving room for exception. However, when it comes to the issues of eLearning in DCs, there are either hidden assumptions or the discussion will focus merely on challenges of technological infrastructure and scarcity of skilled experts. Indeed, eLearning has also brought opportunities, alongside with challenges. The chances are, for instance, tackling problems of access, quality and equity of higher education in DCs through classroom-based and/or life-long and life-wide eLearning, as well as leapfrogging to a knowledge-based socio-economic system, as it has been acclaimed in industrialized countries.

Nonetheless, assumptions on challenges or opportunities remain rather solely theoretical, mainly because it is hardly possible to find traceable best (or worst) practices and cases studies. Moreover, experiences in industrialised countries are also difficult to benchmark or replicate, since the socio-economic and technological environment is different. With this, the primary inquiry of the research is "What makes eLearning different in DCs?"

To answer this broader question, literature survey and field studies had been undertaken. With this the theoretical and analytical framework of the research was set by first defining the critical success factors (CSF), i.e. access to and use of technological infrastructure, self-efficacy, group-based eLearning and ePortfolio use for reflective feedback, in the context of the features of eLearning in DCs. Arguing that eLearning is a heterogenous complex network of actors, namely the technological infrastructure, educational organisations and eLearning societies, CSF, were analysed based on the actor network theory (ANT). Coupled to this, due to the settings of the research, the

methodological approaches of the research are designed based on qualitative research methodologies, namely action research, case study, grounded theory and situation analysis.

To this end, four cycles of case studies, each based on a specific research question, have been realised. The first three case studies were realised based on the questions "How do we capture eLearners' feedback about the eLearning environment and eLearning process, specifically; the technology access and use, the self-efficacy to Internet use and the group-based eLearning? The findings from the three iterative case studies resulting in that the use of ePortfolio to capture reflective feedback had been proposed. Meanwhile, the questions raised in this context were: "Could it be possible to persistently capture, store, and process the required feedback with an ePortfolio"? Moreover, "Can we improve eLearning and eFacilitation through the use of ePortfolio as a repository of reflective feedback"? To deal with these inquiries; a demonstrative Prototype ePortfolio was designed, with the objective of capturing feedback from the critical success factors assessed in previous case studies. For the validity of the artefacts of the demonstrative Prototype, experts' opinion were considered. With this, a prototype ePortfolio has been developed and implemented during the fourth cycle of the case studies.

Finally, due to the use of this ePortfolio, it has become possible to capture feedback from the eLearning environment and process, which as a result helped us to improve communication, interaction and eFacilitation. With this, the iterative implementation of the cycles of case studies has been exhausted and concluded. At last results of the overall research have been summed up as findings and contributions.

Therefore, based on the overall discussions on conceptualisation and contextualisation, this thesis underscores that eLearning shall be conceived as a socio-technological network of actors. In tandem of contextualisation the features of the eLearning in DCs will be carefully considered so that the following models will be realised. The models designed and realised based on the research framework and case study i.e. the prototype ePortfolio in the context of the DCs are:

- The technological infrastructure landscape model: Specifies artefacts and attributes of the technological infrastructure access (access place; bandwidth), use (skill, ownership) and the infrastructure resources (learning management system, communication media)

- The ePortfolio model: The prototype ePortfolio contains an extended profile of eLearners i.e. artefacts such as personal profile, technological infrastructure access and use as well as self-efficacy to Internet use
- The Scenario-based Message-Sequence-Chart (MSC) model: Reveals the communication environment focussed on both technology constraint and non-constrained cases
- An aggregate model for ePortfolio-based reflective feedback. A model that combines the three models mentioned above, embedding them into the framework of the network of actors designed initially and iteratively used in all case studies models

The thesis winds up the research by recommending further development of the ePortfolio prototype on the basis of the designed Aggregate model and models embedded within in this model. These are further developing the prototype ePortfolio based on the model designed, and implemented in real-life projects and also integrating or embedding it in LMS; developing a tool based on MSC to analyse the patterns of communication and interaction; finally, semantically analysing the discourse and the reflective feedback from the intercultural group-based online learning.

Zusammenfassung

In den letzten Jahrzehnten wurden Informations- und Kommunikationstechnologien (IKT) im Bildungsbereich (genannt eLearning) einerseits verstärkt als Forschungs- und Studienrichtung zur Verbesserung des Lernens eingesetzt, und andererseits die IKT als Werkzeug alle Facetten von Bildung und Ausbildung in ausnahmslos allen Ländern überschwemmt haben. Wenn es allerdings darum geht, eLearning in Entwicklungsländern (DCs) einzusetzen ist, scheint es, dass es entweder versteckte Annahmen gibt oder aber die Diskussion wird lediglich auf Herausforderungen vor allem der technologischen Infrastruktur und Mangel an qualifizierten Experten fokussiert. Tatsächlich aber hat das eLearning neben den unbestreitbaren Herausforderungen auch beachtliche Chancen mitgebracht. Diese sind z.B. die Behebung der Zugangsprobleme, eine Verbesserung der Qualität in der Hochschulbildung in Entwicklungsländern, und die Möglichkeit zu einer Form von lebenslangen und lebensbegleitenden Lernen zu finden und damit den Sprung in eine wissensbasierte sozio-ökonomische Gesellschaft zu vollziehen.

Dennoch bleiben Annahmen auf beiden Herausforderungen und Möglichkeiten eher nur theoretisch, vor allem weil es kaum möglich ist, dieser am besten (oder schlecht) Praktiken (Fallstudien) zu finden. Darüber hinaus sind Erfahrungen in den Industrieländern auch schwierig, Benchmark oder replizieren, da das sozio-ökonomischen und technologische Umfeld anders ist. Damit ist die primäre Fragestellung der Forschungsarbeit "Was macht eLearning anders DCs?"

Um diese Frage zu beantworten, wurden im Hintergrund der vorliegenden Arbeit Umfragen durchgeführt und damit die Erforschung des theoretischen und analytischen Rahmens zunächst auf die Definition der als kritisch angesehenen Erfolgsfaktoren (Critical Success Factors CSF), d.h. Zugang zu und Nutzung der technischen Infrastruktur, Selbstwirksamkeit, gruppen-basiertes eLearning, Verwendung von

ePortfolio für reflektierendes Feedback reduziert, und kontextualisiert auf die Eigenschaften des eLearning in Entwicklungsländern bezogen. Neben dem Argument, dass eLearning in einem verschiedenartigen komplexen Netzwerk von Akteuren stattfindet, unter Einschluss der technischen Infrastruktur, der Bildungseinrichtungen und der Lernenden, wurden die analytischen Ansätze besonders hinsichtlich der CSF auch durch die Akteur-Netzwerk-Theorie (ANT) unterstützt. Darüber hinaus wurden die methodische Verfahren auf Grundlage qualitativer Forschungsansätze im Rahmen von "Grounded Theory", Situationsanalyse, Fallstudien und Aktionsforschung entwickelt und durchgeführt.

Hierzu wurden vier Zyklen von Fallstudien durchgeführt, die sich jeweils auf das Forschungsrahmenwerk und eine spezifische Fragestellung bezogen. Die erste drei Fallstudien wurden auf der Grundlage von Fragen: 'Wie können wir Feedback des eLearners über eLearning-Umgebung und -Prozess erfassen?', speziell über Technikzugang und -Nutzung, Selbsteinschätzung, Internetnutzung und gruppenbasiertem eLearning umgesetzt. Die Erkenntnisse aus den iterativen Fallstudien legten den Schluss nahe, ePortfolio-basiertes reflektives Feedback zu nutzen. In diesem Zusammenhang waren die aufgeworfenen Fragen: 'Könnte es möglich sein, die erforderlichen Rückmeldungen mit einem ePortfolio kontinuierlich zu erfassen?' (d.h. zu verarbeiten und zu speichern) und 'Können wir eLearning und eFacilitating durch den Einsatz von ePortfolio als Repositorium von reflektierenden Feedbacks verbessern?'. Um mit diesen Fragen umzugehen, wurde es ein demonstratives ePortfolio entwickelt. Das Ziel war das Feedbackinformation aus der kritischen Faktoren die in der vorangegangenen Fallstudien abgeleitet worden sind, zu erfassen. Um die Gültigkeit des Artefakts von dem demonstrativen ePortfolio beurteilen zu können, die Meinungen von Experten wurde betrachtet. Anschliessend, es wurde, aufbauende auf das demonstratives ePortfolio, ePortfolio Prototyp ('Basic ePortfolio' genannt) wurde für den vierten Zyklus der Fallstudien implementiert und eingesetzt.

Aufgrund des eingesetzten ePortfolio sind die Rückmeldungen aus der eLearning Umgebung und dem eLearning Prozess, die zur Verbesserung der Kommunikation, Interaktion und eFacilitation beitragen, besser gewonnen worden. Damit konnten die zyklischen iterativen Fallstudien abgeschlossen und die Ergebnisse diskutiert werden.

Aus der vorgestellten Kontextualisierung und Kontextualisierung kann als Ergebnis festgehalten werden, dass eLearning als sozio-technisches Netzwerk von Akteuren verstanden werden kann. Dadurch können gerade die Besonderheiten des Kontextes in

Entwicklungsländern zum Ausdruck gebracht werden, was durch die nachfolgenden Modelle seine Entsprechung findet. Die in dieser Arbeit für den Kontext Entwicklungsländer entwickelten und im Prototyp ePortfolio im Rahmen der Fallstudien implementierten Modelle sind:

- Das Modell der technischen Infrastruktur: es repräsentiert Artefakte und Attribute des technischen Zugriffs (Zugangsort; Bandbreite), der technischen Nutzung (Wissen, Eigentum) und die Infrastruktur-Ressourcen (Lernmanagementsysteme, Kommunikations-Medien)
- Das ePortfolio-Modell: es repräsentiert ein Profil des eLearners, d.h. Artefakte wie persönliches Profil, Zugang zu technischer Infrastruktur (TA) und deren Nutzung, (TU) und das Selbstvertrauen zu der Nutzung des Internets auszuarbeiten
- Das Modell des Szenario-basierten Message-Sequence-Chart (MSC): es bildet das Kommunikationsumfeld ab und umfasst sowohl den Normalfall als auch Situationen der technisch eingeschränkten Nutzung im Kontext Entwicklungsländer
- Ein Aggregatmodell für ePortfolio-basiertes reflektives Feedback: es kombiniert die oben genannten drei Modelle und bettet diese in den Rahmen des Netzwerks von beteiligten Akteuren ein

Die Arbeit gibt darüber hinaus Anregungen für die Weiterentwicklung des ePortfolio-Prototyps auf der Grundlage des entworfenen Aggregatsmodells und dessen Nutzung als Instrument zur Analyse von Kommunikation- und Interaktionsmustern und schliesslich eine semantische Analyse des reflektiven Feedbacks aus interkulturellem, gruppenbasierten Online-Lernen.

Chapter 1

Settings and the Research Focus

The main focus of this thesis is ePortfolio-based reflective feedback and its use for eFacilitation in the context of eLearning in developing countries (DCs) with a particular focus on Ethiopian higher education. Use of ePortfolio in eLearning discussed in this thesis has evolved out of learned experiences from iteratively realised four case studies, in which each case study connotes a learning cycle. Based on the learning cycles and learned experiences various models applicable for further use in research and application fields were designed and implemented.

Thus, as a modest beginning, this chapter presents the background and motivations of the thesis. While the background focuses, initially, on eLearning in DCs in general and on Ethiopian higher learning context in particular; the motivation part presents the use of the prevailing state-of-the-art of eLearning technology in education as well as promises and challenges of using this technological infrastructure in DCs where the socio-economic scenery are constraints. Following that, the problem statement and the research questions coupled with the objective and rationale of the thesis are briefly discussed. Finally, the chapter winds up with a concise summary of the findings and the contributions of the research. Highlights to the overall organisation and structure of the thesis are also provided.

1.1 The Background and Motivations

*The roots of the present lie deep in the past*¹

Integration of information and communication technologies (ICT) into education system as a field of study and research, and as tools to enhance education has long been well acknowledged. Davis and Lyytinen [1] revealed how the science of ICT in varied names, as Compute Science, Informatics, Information System Studies, etc, how this field of study came into life (i.e. a mixture of different disciplines) and how, in less than half a century, vigorously spread. Yet more impressive are ICT use as tools, how they have become ubiquitously pervasive and reconfigured across all human activities; be it in education, research, production, distribution, health sector, or the world of entertainment. Hitherto, this phenomenon is prevailing in every society on the globe without exceptions, though, the diffusions and impacts greatly vary [2].

Moreover, ICT use in education as a tool has been considered as much a revolution [3] as a new paradigm shift in knowledge acquisition and transfer. It is thus argued that research in ICT and ICT enhanced learning is debated and as a field of study, it is fluid, since IT-enabled systems are changing and expanding in scope [1].

Towards this end, the researcher born, grown up and studied Economics in Ethiopia (one of the least DCs), studied Informatics in Germany (one of the most industrialised countries), started pondering with curiosity and excitement about knowledge transfer from Germany to Ethiopia based on eLearning. With that, effort was made to conduct a survey of literature in order to obtain general overview of eLearning, particularly its promises and prospects [4]; the paradoxes and controversies [5]; the myths and realities in industrialised countries to learn from practice and experiences. Subsequently, a field study has been organised. Based on these preliminary surveys, the inquiry led to "What will then be eLearning in DCs?" More formally, "What makes eLearning different in DCs [2]?" It was, however, challenging to answer these questions without a careful consideration of realities in the context of DCs and from the point of view of different actors in eLearning i.e. the learning society, educational organisations and technological infrastructure. were not available.

The underlying motivations were therefore based on the field study and observation as well as the survey how eLearning in DCs has become an issue of discussion. In this

¹A Short History of Education (1904) <http://www.socsci.kun.nl>

line, eLearning in DCs is timely issue, to which policy makers, educational institutions and experts in many DCs are seeking solutions to education problems, on one hand, and on the other hand there is an enthusiasm to leapfrog to enter the global knowledge economy induced through use of ICT in education. Coupled with this, the interplay of the supply-push factors have become driving forces to adopt technology enhanced education systems. Moreover, vendors push with a one-size-fits-for-all approach to take advantage of clients' lack of understanding to eLearning [6] and as well as the market gap. The promises attached to education was also to attain the most with less investment (costs).

With this background and motivations, this research started by highlighting eLearning in DCs with special reference to the Ethiopian case. Subsequently, attempt was made to confer with the potency of eLearning as solutions to the prevailing problems of the educational system in DCs. Moreover, it was timely to caution and engage academics, policy makers and practitioners to thoroughly investigate the depth and width of eLearning as a complex socio-technical network of actors.

1.1.1 eLearning in Developing Countries

eLearning that has been a buzzword for the last few decades and began shrinking at its infancy due to the dot-com crisis in industrialized countries [6] [5] [7] has started slowly crossing its boundary and marching towards developing countries as a global phenomenon with promises and challenges. The promises brought by eLearning as an emergent ICT-enhanced system gave rise to the hope that it can tackle problems in the education system of DCs, particularly providing access for steadily growing learning society and improve the quality of learning.

There were indeed affirmative views and optimism on the use of Internet-based learning infrastructure. In this line, McQuaide [8] has also cited successful implementation of advanced ICT to promote rural economy and basic education in developing countries. This was also confirmed by Rabbi and Arefin [9], who optimistically claim that wireless ad hoc networking will provide eLearning even for rural people in DCs and facilitate various educational services, such as Web-based learning, computer-based learning, visual classrooms, and digital collaboration, which were otherwise hard to obtain in underdeveloped areas.

That said, the promises and challenges of eLearning in DCs have become a much more debatable issue other ICT-enhanced services in DCs. This is, among plenty of issues, mainly because whether there is an adequate Infrastructure as well as sufficient skill to effectively use the ICT for learning. Besides, based on few years of experiences, whether introducing technology into education and promoting eLearning in Africa has brought positive change across the continent [10]. In his survey report on 'eLearning in Africa', Unwin [11], has concluded that, though many agree on the importance of eLearning in Africa, there are still inhibiting factors such as:

- Absence of eLearning development strategies
- Absence of good practices
- Poor infrastructures (particularly insufficient connectivity especially in rural areas), as is needed for appropriate training and capacity development
- Lack of relevant digital content
- High cost of implementation

The report by Hollow and ICWE [10] on eLearning in Africa also underscore that there are two controversial arguments pertinent with eLearning development services in Africa. The first argument recognises and endorses that efforts of the last decade have resulted in a new educational landscape. The second argument which was asserted by others experts were, that change acclaimed are unproven and that structural shift, especially within a formal educational context, remains a long term challenge.

Nevertheless, when it comes to eLearning in DCs, the the basic concern was whether eLearning in DCs, driven by complex networks of technological learning infrastructures used in the context of the industrialised countries, is applicable to a socio-economic system characterised by a low level of technological development. This connotes adopting imported technology from the West that is developed in view of primarily meeting certain requirements in that socio-economic environment into the education system of the DCs. This could be analysed from the point of view of the overall prevailing socio-economic situations and skill and expertise required and the degree of acceptance of and full support of the policy makers depends on the anticipated contribution to the development strategies of the DCs.

As long as there are no case studies that reveal real practices and as far as there is no comprehensive study on eLearning, paradoxical discussions on the challenges and promises of eLearning in Africa would go on. In fact, concerns and controversies in eLearning were not only typical of DCs, but there were also similar discussions in industrialised countries, as Carliner and Shank [6] underscored, why people think critically about eLearning, as "Education in general and eLearning in particular, suffers from a strong case of hyperbole. Strong claims were made that neither rooted in solid research nor borne out by practice".

All these make eLearning in DCs is lacking to trace replicable success stories and applicable models, both in industrialized countries as well as in DCs. Proclaimed achievements of eLearning in industrialized countries are posing controversies due to the hypes and the obscuring realities on achievements [12] [13]. On the other hand, since eLearning in the developing countries is still infant and it is too early to draw a conclusion on past performances.

All these assumptions are related with the technological infrastructure to eLearning. Glynn ([14]) argues that there are other vital issues pertinent with research in eLearning to widen the scope of the investigation beyond mere infrastructure problems, though eLearning is not all about technology. He, questioned "What is the role of technology in pedagogy?" The arguments are that technology should support pedagogy - 'not take it hostage' as well, technology is there to empower the student in an online course; and concludes as "Technology has a very valuable role to play in education; as long as it is used appropriately, supports the pedagogy, and does not detract or distract from the content" [14].

Towards this end, Andersson [15] has identified seven major problems of eLearning in DCs, namely student support, flexibility, teaching and learning activities, access, academic confidence, localization and attitudes. This connoted that eLearning is not only technology driven education, but it is also a complex socio-technological network of actors, such as learning society, educational organisation and technological infrastructure.

On the other hand, Machado [16] states that the implementation of learning technologies in DCs is as much a journey as a destination, due to the initial careful analysis of implementation, with attention to the challenges for teaching staff and students, can mean the difference between success and failure. Moreover, without deeper and continuous investigation in the technological and social infrastructures, as Kawachi [17]

underlines, in most DCs, particularly in rural areas, it is easy to imagine that the student is not only physically alone but psychologically and emotionally as well -without social infrastructure supporting eLearning.

With highlighting general and basic issues in eLearning in DCs and cementing the focus area, the next section would give a short overview of eLearning in Ethiopian higher education.

1.1.2 eLearning in Ethiopian Higher Education

Issues related with ICT development services in Ethiopia in general and ICT use in education in particular has become eye-catching. This is mainly because of the controversies in the optimism to use of ICT and the low level of socio-economic development. Saying that, it is worth mentioning, very briefly the profile of Ethiopia.

The profile of Ethiopia indicates that it is one of the second highly populated countries in Africa, with approximately 75.6 million² population which is growing at an annual rate of 2.7% [18]. As it is the case with the demographic features of most DCs, over 45% of its population is under 15 years old. This segment of the population consists of mostly the school-age children.

The socio-economic development indicates that Ethiopia is lagging behind the rest of the world by all measures and indicators [19]. Information on the telecommunication industry in general and Internet connectivity in Ethiopia is reported that the tele-density is 1.06 per 100, while the mobile phone subscribers with 1.45 per 100 are surpassing the landline [20]. Internet users figure shows there were only 291,000 Internet services subscribers of the Ethiopian Telecommunications Corporation (ETC), of which only 3,000 are broadband internet subscribers which makes it about 1% of the total Internet subscribers [20], also one of the lowest rates by sub-Saharan Africa standards.

According to the report of the International Telecommunication Union [20], as of March 2008, only 0.4% of the population has access to telecommunication services. Although, there is a growing trend, particularly in the mobile services, the overall attainment is quite disappointing.

² estimation of 2005

Major preoccupying policy issues and often discussed problems of the education sector are, access, quality and effectiveness and equitability problems, such as low rate of student : teacher and student : text books ratios and inequitable across gender, urban and rural population, and among various regions [21] and [22]. Likewise, ICT use in education is characterised by high student-computer ratio and limited deployment of computer network systems, low bandwidth of Internet connectivity in the universities and colleges. This reveals poor Internet connectivity and as a result difficulties in access online educational resources.

To tackle all these problems, policy makers are undertaking several measures. To this end, the establishment of the Ethiopian ICT-Development Agency (EICTDA) is one of the remarkable steps towards institutionalising ICT development services. EICTDA coordinates and monitors the promotion of ICT based development projects like SchoolNet and eGovernment (known as "WoredaNet" that provide information and communication services for the civil servants). Furthermore, the national development plan recognizes ICT as an enabler for widening access to education, facilitating educational service delivery and training at all levels [23]. With regard to implementing ICT use in education, Hare [23], underlines that "Unlike many African countries where educationalists are still grappling with policy issues and trying to formulate strategies for adoption of ICT within their education sector, Ethiopia has done well in developing a detailed strategy and an accompanying implementation plan all with action plans and time lines".

Based on our preliminary survey [4], eLearning development services per se, in Ethiopia is not, however, yet well established, though there are ad hoc efforts at institutional levels in cooperation with foreign universities. The African Virtual University (AVU) that was hosted and facilitated by Addis Ababa University provided some distance-based education programs until recently. This program was ICT-supported distance education in cooperation with World Bank and the Melbourne Institute of Technology in Australia. On the other hand, the Global Development Learning Network (GDLN); the World Bank program, hosted by the Civil Service College in Addis Ababa provides only video conferencing service to distance learners mainly for the civil servants. The, initiatives and projects like the SchoolNet program which strives to provide access through V-SAT³ to secondary schools, but lacks proper eLearning

³Very Small Aperture Terminal-that is a two-way satellite ground station (satellites in geosynchronous orbit) with a smaller dish antenna used to relay data from small remote earth stations

services.

Coupled with this, there is an initiative at the Ministry of Education that started distance learning using video-conferencing in cooperation with the Indira Gandhi National Open University in India⁴. The project has started registering few students for a master's degree program in economics, marketing, and business administration in collaboration with the Addis Ababa University, Alemaya University [23]. Similarly, St. Mary's College a private higher education institution has also started collaborating with the Indira Gandhi National Open University from India.

Another recent initiative is the ECBP (Engineering Capacity Building Program) Ethio-German cooperation⁵. The ECBP is primarily working in university reform program, the rudimentary tasks envisaged to reuse open course ware developed elsewhere either customised to the needs of the local situations or using them as they are. Though, this initiative is quite new, there are drawbacks seen, namely the feasibility of customisation and comparative costs that are not well anticipated. On the other hand, the program has not yet integrated most of the higher education institutions in the country, who would be implementers and vital stakeholders, in the conceptualisation and development schemes.

All in all, there is a growing interest and awareness to the potentials of integration of eLearning in Ethiopia higher education. However, the challenges are not only immense, but they are not also well conceived, mainly because problems of eLearning are usually seen solely from the point of view of technological infrastructure problems.

1.1.3 Education Problems vs. eLearning Solutions

During the last few decades, many countries (all over the world) have been responding to the challenges of globalisation they encountered by expanding their higher (terminals) to other terminals (in mesh configurations) or master earth station "hubs" (in star configurations). VSATs are most commonly used to transmit narrowband data mostly for transportable or mobile communications

⁴Interview with Mr. Fekadu Mulugeta, Vice President of Distance and Continuing Education, Addis Ababa University

⁵This initiative and the then project was initiated and consulted by the experts from TIS-FB-Informatik, i.e. Prof. Dr.-Ing. D.P.F. Moeller and the research of this thesis, and it were sponsored by the German Technical Cooperation Agency (GTZ) and The Ministry of Capacity Build (MoCB) of the Ethiopian Government.

education systems, mainly through massification [24]. On top of that, the knowledge-economy at the globalised information age; the requirement for new type of skills and the need for lifelong learning have become factors to widen the doors of higher learning institutions more than ever, which as a result intensified access problems, especially in DCs. In these cases, ICT use in distance learning has been considered as an effective instrument due to speculated cost-effectiveness tackle educational institutional problems in DCs, particularly in sub-Saharan Africa [25].

It is thus argued that, access to Internet is growing relatively fast, where access for and use of ICT in education in many African countries are also at a dynamic stage [23]. The hope attached to promote eLearning in DCs to integrate ICT in the strategic development plan are considering high rate of population growth as a potential and comparative advantage to leapfrog to knowledge-economy. Favourable conditions prevailing are also the prices of technologies that are steadily declining; in as much as it has become relatively affordable.

Moreover, the persuasive natures of these technologies have greatly influenced and intentionally changed people's attitude or behaviours [26]. Chee [27], referring to several authors including Rosenberg [5], concludes that Internet technology has been heralded as the next great "restructuring" technology that further transforms the world into a global village of unbridled connectivity, particularly ICT use and eLearning.

The driving force at the core of the eLearning transformation is the Internet. In this line the Internet is considered as the cutting-edge technological revolution and the wave of innovation that is changing education. Information and communication technologies facilitating innovations in education [28] are:

- Rapid development in emergent and pervasive communication technology, such as asynchronous/ synchronous interaction, tele/video conferencing, group and peer virtual discussion, instant messaging, etc.
- Development of high quality multimedia enhanced interactive learning material
- Development of vigorous application software, particularly LMS - innovative tool used in content developing, integrating and sharing, delivering contents and facilitating virtually to administer teaching/learning processes as well as performance, and the Web 2.0 as well as the social software that are radically

changing the role of users from passive to active content (knowledge) suppliers [29]

- Modelling and simulation particularly in enhancing virtual laboratories in engineering and the medical sectors

On the other hand, from the pedagogical point of view, constructivists emphasise the significance of a learner in educational processes, arguing that when applied correctly, technology improves the quality of learning experiences, if applied properly. Besides, they argue that technology enables students to actively engage in the construction (rather than the passive receipt) of knowledge. Authors such as Fox and Mills [30] for example, expect web-technologies to totally change distance education. In this case, web-based distance education technologies should improve education and support new educational systems, thereby radically changing traditional universities.

With this it is believed that eLearning is rapidly and imposingly stretched over the educational systems of the DCs, mainly due to the interplay of the demand for and the supply of technological infrastructure and the push-pull effects. As this is a theme broader than the scope of the thesis, it suffice to depict diagrammatically (Figure 1.1) the overwhelming technological infrastructure (technology-push), the rapidly growing learning society (society pull), and the desperate educational organisations (organisational-push-pull coordination) look for instruments to do more with less.

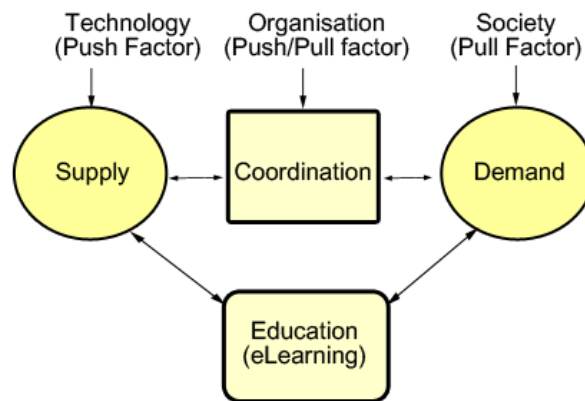


Figure 1.1: Push-Pull Factors in eLearning Development in DCs

Therefore, there have been efforts made to provide access through massification and expansion of higher education with less resources as well as by simply introducing

eLearning without acknowledging the paradigm shift and equipping with the necessary technological infrastructure and efficient support services. This, however, poses multiple problems, such as inferior quality of education and intensifies problems of providing effective services by trained instructors and tutors. This often leads to high drop out rates.

On the other hand, it seems that eLearning in DCs has become a choice of necessity as well as an opportunity with challenges. This puts indeed eLearning in DCs at a crossroad; being pushed by the pervasive and emergent global ICT (supply-side) while there are severe problems in access for and quality of higher education, and on the other hand knowledge has become more important. In this case problems arise as there appears to be a trade-off between improving quality and providing more access to the learning society (increase access at the cost of decreasing quality or increase quality but forgo for access, i.e. access problems remain aggravating).

Therefore it is not only putting technological infrastructure in place to merely boost access (which might of course be a matter of inducing more investment, referring to our experience from the realised case study), but, more demanding and challenging is establishing conducive institutional support services, such as offering intensive eFacilitating to eLearners. Besides, the changes are providing comparably affordable eLearning with high quality of connectivity and robust, flexibly configurable and interoperable learning management systems accompanied by learnable materials (contents) that serve the objective of self-regulating learning pedagogical system, are vital. Finally, it is also important to continuously train support services providers and eLearning to keep them effectively use the technological infrastructure for learning. These and other concerns are mainly daunting organisational tasks peculiar to eLearning in DCs, which might not come into questions in the Western industrialised countries, where technological infrastructure is less a concern, or not a problem at all.

In other words, the driving forces for eLearning in DCs are problems in the education system and opting to tackle these problems with technological solution. As it is attempted to summarise eLearning solutions, most efforts are focussed on mere technological solutions, though, the notion "eLearning is not only technology" is a hard-fact experienced by early starters in the West, who at the end paid dear as promoting eLearning was merely skewed towards inducing technological infrastructure neglecting other vital actors, such as eLearners and education organisations. In this case the boom has, in many cases, ended with burst [13].

With this, the overall discussion on technological infrastructure as a solution to educational problems in DCs could be summed up as 'solutions with shadow' may result in 'problems in shadow' as depicted on the diagram Figure 1.2. These are the background and motivations that led us to give details of insight into the controversies on opportunities and challenges of ICT use in education in the context of DCs. To this end, the conceptual framework this research constitutes is based on this background.

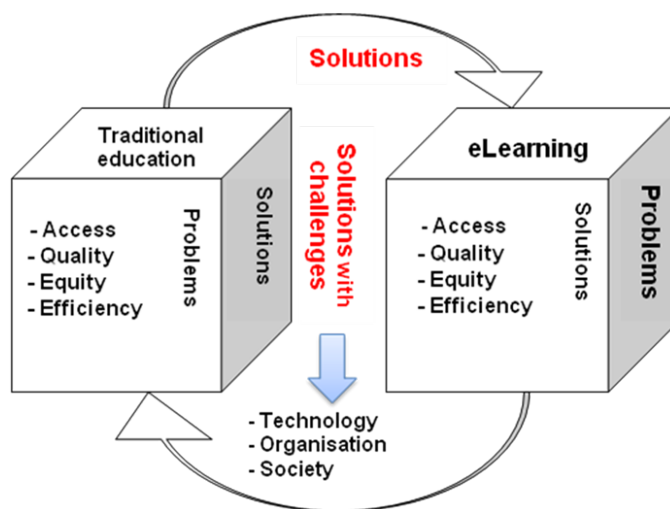


Figure 1.2: Education Problems and eLearning Solutions

1.2 The Research

This part of the thesis briefly highlights the main focus of the research by defining the problem domain in general and the specific research questions, as well as the research objective and scope.

1.2.1 Problem Statement

The underlying background and motivation in this milieu commences initially with reviewing the promises and opportunities of ICT use in education (eLearning) to tackle the severe problems in access, quality and equitability of tertiary education,

while encountered by multifaceted challenges, particularly related to the requirements for eLearning. As it has been discussed in the background and motivation section, eLearning is not only a constituent of a single actor-technology, but it is a combination of a complex network of various socio-technical actors. The key issues raised in this regard led towards the basic inquiry "what makes eLearning in DCs different?"

In order to refine and closely investigate these quite broader inquiries, the thesis has highlighted the scenery of the research framework by defining actors, their role and relationship. So far, eLearning is a complex socio-technical network of actors, whose main actors are eLearning technological infrastructure, educational organisation, and the learning society. Major concerns in this vein are:

- Technological Infrastructure for eLearning:
 - The first and foremost concern is identifying real requirements and needs in technological infrastructure for eLearning and coping with standards.
 - Problems also arise with ensuring accessibility, affordability and usability of technological infrastructure for eLearning. Heavy weight multimedia enhanced contents coupled with the heavy traffic created by entertainment and social networking applications require a high capacity and robust infrastructure, which may be a non-concern area in the industrial countries, but crucially vital for eLearning in DCs.
 - The other problems are effective use of technological infrastructures for eLearning. Although, much have been said that ICT are rapidly diffusing and become quite persuasive in all facets of human activities particularly their use for entertainment and other social network and communications, ICT use for eLearning is different. In this connection it has been observed that, when it comes to use of ICT for eLearning, it remained as hidden assumptions, i.e. it is assumed that if you build it, they will use it [5].
- Organisational and Pedagogical Issues: The second concern is awareness and readiness (possessing the capacity) of educational organisations to provide sustainable and persistent support services such as student centred self-regulated learning through eFacilitation. Coupled with this, it is expected to design, develop, and deliver quality services in short period of time with less costs to many eLearners as much as possible, who may flexibly access the eLearning

resources (eLearning platform or as commonly known - Learning Management System-LMS) anytime from anywhere. Besides, it is expected to support active participation particularly in providing feedback on learning process and eLearning environment.

- **Socio-Cultural Issues:** The third concern is conceptualisation of the paradigm shift brought by the emergent technological innovation in eLearning and the redefinition of roles of actors and the relationship among the network of actors, mainly students role in eLearning. Student-centred and self-paced life-long and life-wide learning imperatively requires an increased active participating role of eLearners, but it is also essential to have the necessary skills and motivations to effectively use the eLearning technological infrastructure. In addition to that, often not properly disclosed issues, are cultural aspects of eLearners while communicating and interacting virtually to enhance group or collaborative eLearning, knowledge sharing and critically discussing or providing feedback, etc.

Therefore, conceptually and methodologically, the analysis of features of eLearning needs to be studied from the point of view of actor network theories (ANT), which is wide spread and proven analytical tool in several fields. Accordingly the network of actors will be held sustainable as long as a specific interest of each actor has been kept fulfilled within the symmetrical mutual co-existing network [31].

To maintain a balanced sustainable network of actors and to enhance eLearning, this thesis defines some basic critical resources and constraints, defined as critical success factors (CSFs). CSFs are artefacts of actors whose fulfilment are basic conditions for the establishment of the network of actors [31]. Among which access and use of technological infrastructure by eLearners and providing effective services to eLearners by the educational organisations are decisive. In other words, CSFs identified and defined for further investigation throughout the thesis, are:

- Access to eLearning technological infrastructure (TA) - eLearners and educational organisations require to fulfil certain requirements or conditions
- Use of eLearning technological infrastructure (TU) - eLearners and educational organisations ought to be in a position to effectively use the TA
- Self-efficacy to Internet (ISE) - belief and confidence in one's own capabilities in Internet use for eLearning

- eLearners perception, motivation expectations and experiences in group or collaborative eLearning (G-eL)
- Use of ePortfolio in eLearning as a repository of capturing and providing reflective feedback to improve communication and interaction as well as eFacilitation

These CSFs are defined inductively through learned experiences, i.e. the case studies as part of the refinement of the general issues to particulars. Therefore, the case study is realised in four cycles of case studies each with peculiar problems. Moreover, problems raised initially and also subsequently are continuously reassessed in addition to newly prevailed issues at each cycle.

Finally, the main problem rests on the mechanisms of getting vital information about the Critical success factors described and how to store, process and publish captured information. The thesis finally attempts to dwell on specific problem areas, namely eLearners' reflective feedback from the eLearning environment (in this case the technological infrastructure use for eLearning) and learning process in the context of DCs.

1.2.2 Research Questions

The research question commences initially with a general inquiry, as it has been stated before. To deal with questions, effort was made to define the critical success factors step-by-step to reveal specific features of eLearning in DCs. Parallel to that, critical success factors are investigated in line with actors and the network of actors vital for a sustainable eLearning services development. Subsequently, as discussed earlier, apparent questions as the technological infrastructure services required for eLearning are taken into considerations.

The first three research questions are summarised as, "How do we capture eLearners' feedback about the eLearning environment, i.e. mainly about:

- Technology access and use?
- eLearners' technology access and use as well as self-efficacy to Internet use?
- eLearners' technology access and use as well as self-efficacy to Internet use and group or collaborative eLearning?

Based on these questions investigation has been undertaken, to which the findings from the third question concluded that it would be advisable to use of an ePortfolio proposed as a useful tool to capture feedback. Therefore the fourth research question is formulated as:

- Can we capture reflective feedback with ePortfolio from eLearning process and the eLearning environment mainly from the eLearners' technology access and use as well as self-efficacy to Internet use and group or collaborative eLearning?
- Can we improve communication and interaction among heterogeneous groups of eLearners who strive to learn in group, by capturing reflective feedback with ePortfolio?

With this background and upon steadily refining the inquiry, the thesis ponders the realities on the ground and the prospects of ePortfolio use for reflective feedback from eLearning process and environment in DCs. Furthermore, the thesis concluded by underscoring the need for use of ePortfolio-based reflective feedback from the eLearning environment and eLearning process.

The specific focus is on designing, implementing and evaluating an ePortfolio use in eLearning in DCs to augment reflective feedback from the self-regulated eLearning process and online environment; and finally, capturing learned experiences with a model. The overall investigation and exploration of the thesis are aimed at acquiring academic knowledge on eLearning and ePortfolio use in eLearning that would initiate further discussions.

1.3 The Findings and Contributions

This thesis has thoroughly investigated various critical success factors (CSFs) revealing peculiar features of eLearning in the context of DCs, by associating the CSFs with major actors and network of these actors. Beside attention is paid how to capture reflective feedback from the eLearning environment and process particularly with a spotlight on the given socio-economic and political system where the technological infrastructure is at a quite low level of development. Therefore this research has proposed that the eLearning system in DCs need a special focus, mainly due to the

Internet connectivity and skill expected to possess to effectively use the necessary infrastructure.

Major findings and learned experiences from this thesis are the need to use ePortfolio to capture process and publish reflective feedback from the eLearning process and environment. Coupled with this, eLearning in DCs (contextualisation) shall be conceived from the point of the complex network of various actors (conceptualisation), namely, technological infrastructure, educational organisation and eLearners that could be studied on the basis of the Actor Network Theory (ANT). Alongside with this, the thesis has defined basic features of eLearning in DCs as critical success factors. These are indeed the foundation for the research framework as well as the practical investigations.

The research is hoped to fill the knowledge gap on eLearning in DCs as well as ePortfolio use for reflective feedback in general and for eFacilitation in particular. On the other side, the series of models evolved out of the practical investigations are iteratively used as well as extended to refine the investigation. These are identification of technological infrastructure landscape, introducing extended profile (i.e. including technology access and use and self-efficacy, explicitly as part of the profile of eLearners) of eLearners while designing and developing ePortfolio, and the scenario-based feedback. These models are basic contributions that lay ground for further research and practical use.

1.4 The Thesis Structure and Organisation

The development and organisation of this thesis is a non-linear complex process and an interwoven network of structures of the chapters and sections. In most of the cases, the development process is featured as an iterative action and progressively glued learning experiences, where the analysis often either backtracks to previous (preceding) parts or refer to succeeding chapters and sections.

For a view at a glance, the overall structure and organisation of the thesis is diagrammatically summarized and depicted as provided in Figure 1.3. The graphic shows briefly the non-linearity of the structure of the theses as well as the traversal action backtracking and retracing recursively to either validate or refer from previously discussed parts.

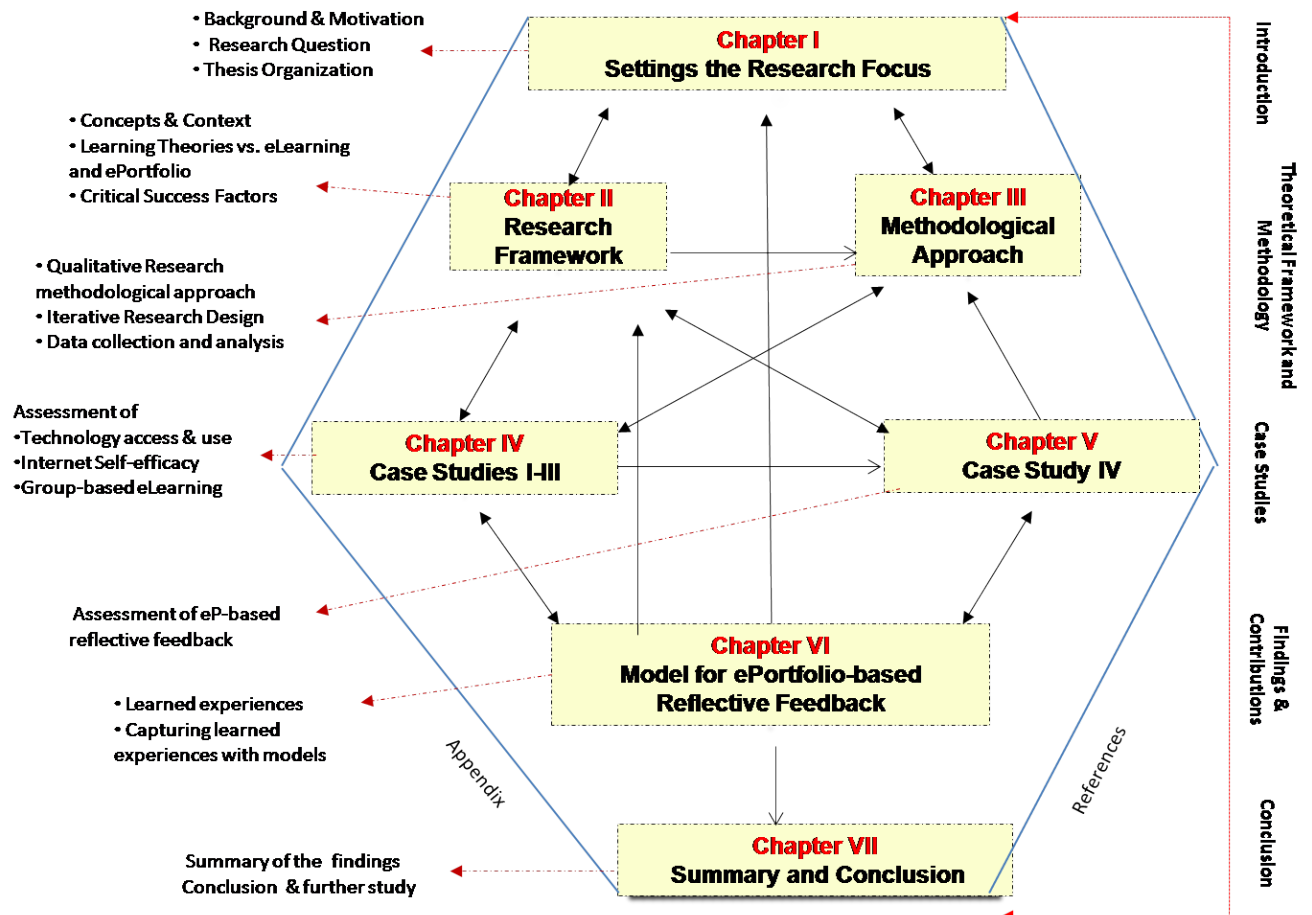


Figure 1.3: Thesis Organisation and Structure

To this end, the first chapter gives insight into the thesis with a specific emphasis on the background and motivation, focussing on eLearning in DCs with special reference to the Ethiopian case. Subsequently follows the highlight of the research, i.e. the problem statement and research questions, the objective. Finally the summary of the findings of the study and its contribution and the organisation of the thesis report are provided.

Following this, the second chapter briefly discusses the research framework of the study. The framework is coined with and built upon a general enquiry "What makes eLearning different in developing countries" and proceeds with inductive discussion.

For the sake of clarity and scope delineation, we begin with defining vital concepts and the critical success factors for sustainable development of eLearning.

The third chapter overviews the research methodological approach used. The methodology is based on the qualitative research methodology. The research is based on an iterative case-based action research. Data are collected and processed at various stage of the case study. Data has been collected using various means, such as guided interviews, Email, discussion board, log files from the LMS, and at last from eLearners ePortfolio.

Based on stated methodological approach and design, four case studies have been realised in which brief summaries of the first three case studies are discussed in chapter four.

Chapter five throws light on the fourth case study, to which technology access and use, group or collaborative online learning and self-efficacy are assessed using ePortfolio-based reflective feedback. To serve this case, a prototype ePortfolio has been designed and developed. Participants were invited from 16 countries, from nearly all continents (except Latin America). At this stage, where the numbers of participants were quite diverse and huge, issues related with eFacilitation have also become vital.

Chapter six, briefly discusses the findings and outcome of the overall study and finally presents models as the final contribution of the research. These models are systematically designed based on the other and finally integrated as an aggregate model for ePortfolio-based reflective feedback in the context of DCs. At last, chapter seven summarises the whole research endeavour and concludes highlighting the findings and the contributions as well as areas for future research.

Chapter 2

Theoretical Background and Research Framework

2.1 Introduction

The focal point of this chapter is highlighting the theoretical and analytical foundations to underscore the research framework. The theoretical aspect briefly spotlight the basic issues related with learning theories and models that are well established and practised for long years. The discussions on the theoretical and analytical foundations have laid down vital knowledge to overview and associate the newly prevailing concepts like eLearning, ePortfolio, eFacilitation, etc. with the hitherto practices.

Research in eLearning is multifaceted (multidisciplinary and interdisciplinary) that covers a vast range of topics, driven by dynamically changing technologies [32]. The impacts of integrating these technologies into the education system; the attainment of targeted goals (positive results) and maintaining sustainable development have been and will be engaging for most researchers and practitioners. Two of the major engaging issues are the integration of ICT (technological infrastructure) in education and redefining the pedagogical theories and models to suite and support the paradigm shift appearing in education towards technology enhancement. Both the theories of learning and use of technologies for learning have long history to which all facets of review on eLearning underscore these issues. Thus, discussions on eLearning are focussing on conceptualisation and justification of the paradigm shift [32] driven by

technological innovation in education.

While assessment of the theoretical foundations overviews the learning / eLearning issues; the analytical tools comprise to the actor network theory (ANT). Besides, the conceptual issues of the message sequence charts (MSC)-as conceptual tools to analyse feedback process, have been also briefly discussed. The overall objectives are to substantiate discussions pertaining synthesise eLearning, ePortfolio use as repository of reflective feedback by association with established theories and proven practices. With this background, the theoretical discussion began by throwing light on learning theories and models.

By way of highlighting the theoretical basis, the research framework discerned the critical success factors (CSF) for sustainable eLearning and ePortfolio use in eLearning to enhance feedback and eFacilitation. Aside from that, effort is also made to relate the theoretical and analytical discussions with the CSF to harness the research with a wider scope.

2.2 Theoretical Foundations and Models

2.2.1 Learning Theories and Models

Learning theory have been extensively studied and intensively debated for decades by several pedagogical experts and scientists, as well as educational psychologists. Details of discussion issues related with learning theories are beyond the scope of this thesis. However, a brief summary of the major categories of learning theories and models, such as the behaviourism, cognitivism, constructivism, and humanism is presented.

1. *Behaviorism*

The core concept behaviourist school of thought is, as it is postulated by Mödritscher [33], that "learning is a change in observable behaviour caused by external stimuli in environment". This theory has been extensively studied by various educational psychologist, such as I. Pavlov, B. F. Skinner E. L.

Thorndike, A. Bandura, J. B. Watson, E. Tolman, etc., though major originators and promoters of behaviouralism learning theory moved ¹ to other theories [34]. Major contributions of the behavioralims learning theory are the structured deductive approach to design an online course, so that basic concepts, skills, and factual information can rapidly be acquired by the eLearners ; and the concept of drill and practice, portioning materials and assessing learner's achievement levels, and giving external feedback [33]. According to Mödritscher [33], however, the effectiveness of behaviouralism school of thought on instruction design approaches for higher-order learning tasks or for transfer of learning, is as yet unproven.

The contributions of the behaviorism theory of learning has still relevance particularly in the case of eLearning and eFacilitation. Content developers and eFacilitators are revisiting the behavioralist theory to understand the behaviour of eLearners [35] [33].

2. *Cognitivism*

Due to weakness of the behavioralism [34], in the 1960s and even later, the cognitive paradigm came into begin essentially arguing that 'people are not 'programmed animals' that merely respond to environmental stimuli; people are rational beings that require active participation in order to learn, and whose actions are a consequence of thinking. Since then, cognitivism is still widely used and is being diversified.

There are many models in the cognitive learning theory category, of which well known is Bloom's taxonomy (the Taxonomy of the Cognitive Domain). The ***Bloom's Taxonomy*** has coined its name since 1956 [34], where a group of educational psychologists, headed by Benjamin Bloom, released *Bloom's Taxonomy of the Cognitive Domain* as a categorization of educational goals and objectives.

This taxonomy has not only got high recognition in education research, but it also has retained considerable relevance even to eLearning and ePortfolio use in education. The most important premise of the taxonomy is that educational goals and objectives can be arranged in a hierarchical category from less to

¹To mention few, Thorndike began to promote connectionism, while Bandura is associated with 'Social Learning Theories' and Tolman moved toward cognitivism

more complex [36], i.e., 'Lower Order Thinking Skills' to 'Higher Order Thinking Skills'. Furthermore, pedagogical experts often set learning objectives based on the Bloom's Taxonomy, mainly as affective, psychomotor, and cognitive domains. To this end, an example of Bloom's taxonomy of the cognitive model is provided in Figure 2.1.

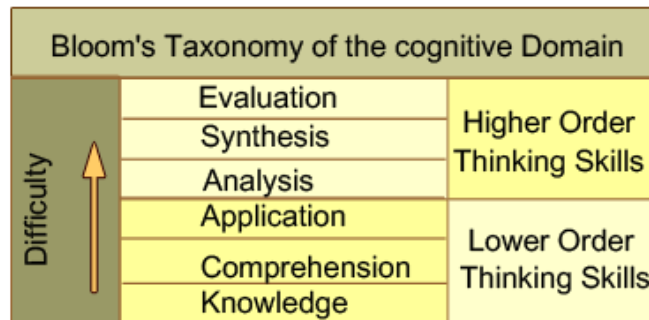


Figure 2.1: Bloom's Taxonomy of the Cognitive Domain)

In order to highlight the classification of the Taxonomy of the Cognitive Domain, each element of the classification is elaborated with a corresponding useful verbs, as summarized in table containing useful verbs that are depicted in Table 2.1. These verbs may be useful for several purposes, say for instance in semantic analysis or simple text analysis, particularly where discussion and exchange of information among participants dominantly prevail, as this is seen during our case study analysis. Besides, this classification could be also vital to process and analyse communication and interaction among various participants of a given social network as well as reflective feedback from groups' eLearners.

The strength of Bloom's Taxonomy and the category still lies on educators who are seeking to engage learners in meaningful learning experiences. For instance the categories approaching the top of the hierarchy are those requiring more processing of information, where the upper categories are higher order thinking skills.

According to Holmes and Gardner [13]

Readers versed in education theory will no doubt recognize a resonance between the framework of eLearning practices and Bloom's tax-

Classifications	Functions	Useful Verbs
Knowledge	recall of specific information	tell; list; describe, relate, locate, write, find, state, name
Comprehension	understanding of what was read	explain, interpret, outline, discuss, distinguish, predict, restate, translate, compare, describe
Application	the converting of abstract content to concrete situations	solve, show, use, illustrate, construct, complete, examine, classify
Analysis	comparison and contrast of the content to personal experiences	analyze, distinguish, examine, compare, contrast, investigate, categorize, identify, explain, separate, advertise
Synthesis	organization of thoughts, ideas, and information from the content	Invent, compose, predict, plan, construct, design, imagine propose devise formulate
Evaluation	judgment and evaluation of characters, actions, outcome, etc., for personal reflection and understanding	judge, select, choose, decide, justify, debate, verify, argue, recommend, assess, discuss, rate, prioritise, determine

Table 2.1: Useful Verbs in Bloom's Taxonomy

onomy of increasingly sophisticated intellectual skills, namely: knowledge, comprehension, application, analysis, synthesis, and evaluation.

This category is often used by eLearning instruction designers and digital content developers.

3. *Constructionism*

The constructionism paradigm posits that learning is not only an active, but also constructive process, where a learner is an information constructor [34]. In this regard, learners are actively constructing or creating their own subjective representations of objective reality or from what their environment, what have leaned. Therefore, the newly gained knowledge will be associated (linked) to

prior knowledge.

The constructionism has been greatly diversified in many ways such as 'Discovery Learning'², Goal Based Scenarios³, Problem-Based Learning, Situated Learning, etc. Learning theories and models in this category are Vygotsk's Social Development Theory and Lave and Wenger's Communities of Practice (CoP).

Vygotsky's Theory of Social Development Learning

Vygotsky's theory of social development learning is one of the foundations of constructivism [34] This theory argues that social interaction precedes development; consciousness and cognition is the end product of socialization and social behaviour [34]. Vygotsky's contributions are considered as basic foundations of constructivism theory. In this regard, Vygotsky's contributions are also vital to study the social an behavioral interaction and communication among online learners. This in mind, Vygotsky's Theory of Social Development Learning are classified into into three categories [37], as provided below.

- Social interaction plays a fundamental role in the process of cognitive development.
- The More Knowledgeable Other (MKO), that refers to anyone who has a better understanding or a higher ability level than the learner (teacher, coach, or older adult, could also be peers, a younger person, or even computers), with respect to a particular task, process, or concept.
- According to Vygotsky, learning occurred in 'The Zone of Proximal Development (ZPD)', which is meant the distance between a student's ability to perform a task under adult guidance and/or with peer collaboration and the student's ability solving the problem independently.

On the other hand, Vygotskys connections between people and the socio-cultural context in which they act and interact in shared experiences Crawford [38] endorses learning with contexts in which students play an active role in learning.

²The concept of discovery learning has appeared numerous times throughout history as a part of the educational philosophy of many great philosophers particularly Rousseau, Pestalozzi and Dewey. (Source: <http://www.nwlink.com/~donclark/hrd/history/discovery.html>, accessed 18.10.2009)

³There are detail discussions in Schank, R. C. (1994). Goal-Based Scenarios: A Radical Look at Education. *Journal of the Learning Sciences*, 3(4), 429-453'. which is, however, beyond the reach of this thesis.

According to this theory, eLearners active role is gradually approaching towards teacher-student collaboration in order to help facilitating meaning construction to which learning becomes a 'reciprocal experience' for the students and teacher, as well as eLearners centred paradigm.

Lave and Wenger's Communities of Practice

Communities of Practice can be defined [39] in part, as a process of social learning that occurs when people who have a common interest in a subject or area collaborate over an extended period of time, sharing ideas and strategies, determine solutions, and build innovations. Wenger [39] gives a simple definition: "Communities of practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly."

Learning can be, and often is, an incidental outcome that accompanies these social processes [34]. In this context, Lave and Wenger's Communities of Practice [39], has established a thought on the communities of practice which is notion of legitimate peripheral participation, where groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly.

With the flourishing of online communities on the Internet, as well as the increasing need for improved knowledge management, there has been much more interest as of late in communities of practice [39]. People see them as ways of promoting innovation, developing social capital, facilitating and spreading knowledge within a group, spreading existing tacit knowledge, etc. In this connection, there are three requirements for components of communities of practice. These are [34]:

- Shared domain of interest with commitment
- Members of a specific domain that interact and engage in shared activities, help each other, and share information with each other
- Members are practitioners who develop a shared repertoire of resources which can include stories, helpful tools, experiences, stories, ways of handling typical problems, etc.

4. *Humanism*

The humanism theory of learning is another category, which is based on a mixture of philosophical and pedagogical paradigms. According to the sources from

the LTK [34], humanists believe that it is vital to study the person as a whole, particularly as an individual that grows and develops over the lifespan. A primary purpose of humanism is describing the development of self-actualisation, motivation, and goals of individual learners. This leads to that in humanism, learning is student centred and personalized, and the educator's role is that of a facilitator, to which affective and cognitive needs are keys, and the goal is to develop self-actualized people in a cooperative, supportive environment [34].

Major models in this category, which are of interest to our case are, Bandura's Social Learning Theories, Kolb's experimental learning theory, Huit's [40] humanism and open education analysis, Rogers facilitative teaching and Maslow's Hierarchy of Needs.

Kolb's Experimental Learning Cycles

Another widely used humanism learning theory is the Kolb's [41]: experiential learning cycles model defines learning as "the process whereby knowledge is created through the transformation of experience. Kolb's learning theory sets out a cyclical model of learning, consisting of four stages⁴ namely [41]:

- Immediate or concrete experiences
- Reflective observation or observations and reflections
- Abstract Conceptualization)
- Active Experimentation

The four-stage cyclical model of Kolb's Experimental Learning Cycles of learning is depicted in Figure 2.2.

Bandura's Social Learning Theories and Self-Efficacy

Bandura's Social Learning Theories posits that people learn from one another, via observation, imitation, and modelling. Moreover this theory explains that human behaviour in terms of continuous reciprocal interaction between cognitive, behavioural, and environmental influences. Bandura [34] enlists necessary conditions for effective modelling, as attention, retention, reproduction and motivation.

One of the most widely used theories in education and psychology contributed by Albert Bandura is the theory on *Self-efficacy*. Bandura [42] defines self-efficacy as,

⁴One may begin at any stage, but must follow each other in the sequence

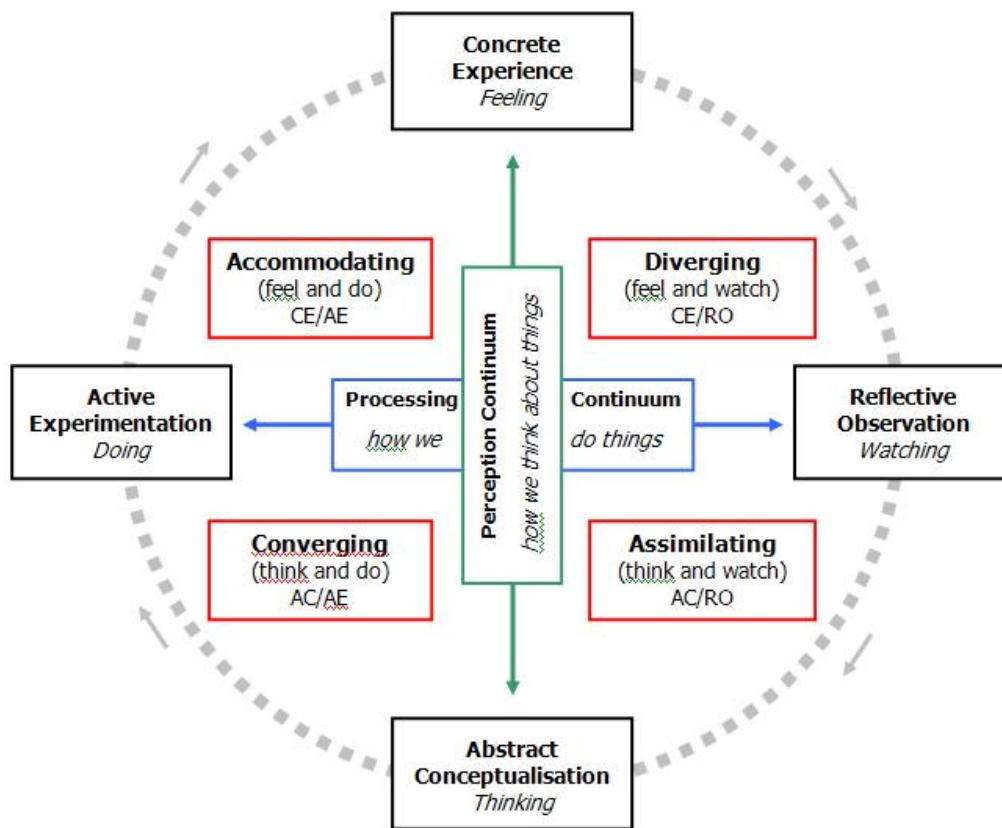


Figure 2.2: Kolbs Learning Styles

perceived self-efficacy, defined as people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives. Self-efficacy beliefs determine how people feel, think, motivate themselves and behave. Such beliefs produce these diverse effects through four major processes. They include cognitive, motivational, affective and selection processes.

Bandura, bridging up his Social Learning Theories and Self-Efficacy, underpins learning not as mere acquisition of knowledge in a cognitively reactive sense; but it involves the development of self-beliefs and self-regulatory capabilities of students to educate themselves throughout their lifetime. Moreover, self-regulatory skills for acquiring knowledge, such as goal setting, self-monitoring, and self-evaluation, are very indispensable for contemporary students because of the rapid pace of technological change, most particularly in the Internet world, and accelerated growth of knowledge [43].

Hence, Zimmerman and Schunk [44] cite what Bandura once depicted "people" as "self-organizing, proactive, self-reflective, and self-regulative in thought and action rather than as merely reactive to social environmental or inner cognitive-affective forces". In general, the theory of self-efficacy is actually applicable to several fields, including eLearning, particularly in the study and analysis of eLearners technology use and collaborative online learning.

Rogers facilitative teaching

eFacilitation as a humanist learning theory has become also a topic of discussion with the rapid development of online learning. The eFacilitation, which is designated in various names such as eModeration, or eTutoring, or simply online mentoring/tutoring, has a solid pedagogical basis to which eLearning can also benefit.

By the end of 1960s Carl Rogers has developed a facilitative teaching model, based on facilitative conditions (including empathy, congruence, and positive regard) in an open education and distance education [40]. The facilitative teaching model, that laid basic concepts for the online facilitations are underpinned by Roger that the function of the teacher (facilitator, in this case) is to facilitate learning by providing the conditions which lead to meaningful or significant self-directed learning, with the aim of developing community of learners-a group including the teacher [45].

In line with this, Huitt [40] classifies Rogers' facilitative teaching model that stated as how genuine, authentic and honest teachers tended to provide more

- Response to student feeling;
- Use of student ideas in ongoing instructional interactions;
- Discussion with students (dialogue);
- Praise of students;
- Congruent teacher talk (less ritualistic);
- Tailoring of contents to the individual student's frame of reference (explanations created to fit the immediate needs of the learners); and
- Smiling with students.

Similarly, Patterson [45], referring to Rogers 'Freedom to Learn' argues that "if the teaching-learning process is a relationship or an encounter between a facilitator and

a learner, then the learner must be a participant in the process". In this case, he mentioned three conditions involving the learner which are necessary for learning to occur, namely perception of the facilitative conditions, awareness of a problem (i.e. response to a situation perceived as real, as relevant, meaningful problems and issues regarding their existence which they must resolve) and motivation.

Salmon's eModeration

The 5 stage model for eModeration developed by Salmon [46] summed up the way online learning could be effectively facilitated. The Model is about primarily integration of both synchronous and asynchronous computer-mediated conferences into online (or distance) learning. It is a tool to conduct computer mediated conferences in a community environment indicative of active, practical, theoretical and reflective learning [46].

The most important contribution of Salmon is the five stages model which is widespread and often quoted. Salmon [46] briefly summarises the five stages as follows.

- Stage 1: This is the base of the flights of steps, which highlights individual's access and the ability of participants to use the computer mediated communication (CMC), which are essential prerequisites for conference participation.
- Stage 2: This stage involves individual participants establishing their online identities and then finding others with whom to interact.
- Stage 3: At stage three, participants give information relevant to the course to each other. Up to and including stage three, a form of co-operation occurs, i.e. support for each person's goals.
- Stage 4: At stage four, course-related group discussions occur and the interaction becomes more collaborative. The communication depends on the establishment of common understandings.
- Stage 5: At stage five, participants look for more benefits from the system to help them achieve personal goals, explore how to integrate CMC into other forms of learning and reflect on the learning processes.

According to Salmon [46], each stage requires participants to master certain technical skills (shown in the bottom left of each step) and also different e-moderating skills (shown on the right top of each step), whereas, the "interactivity bar" running along

the right of the flight of steps suggests the intensity of interactivity that you can expect between the participants at each stage. Furthermore, she elaborated that the step-by-step interaction from limited to more elaborated and extensive, where at the highest stage ('Stage five') it results in a return to more individual pursuits. The five stages model for eModeration is depicted in Figure 2.3.

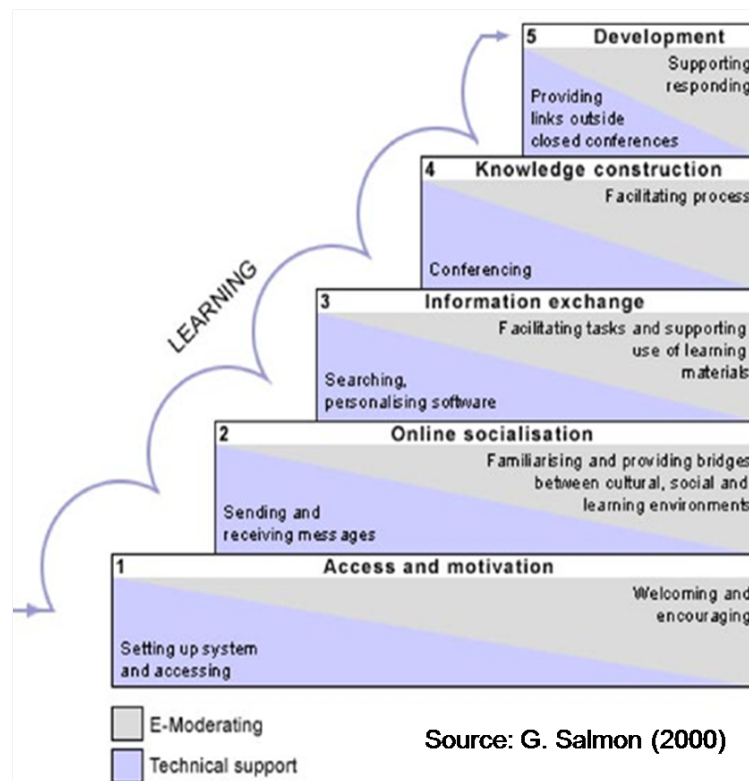


Figure 2.3: 5 Stages Model for eModeration

In a nutshell, the above learning theories and models have been well established and widely used in many researches in eLearning. These have also relied on these theories and models while analysing eLearning in general and in DCs in particular. Besides, these learning theories and models are vital to substantiate the importance of ePortfolio use for reflective feedback in eLearning to which knowledge on the students' eLearning environment and their use of this environment (i.e. eLearning process) are indispensable.

2.2.2 eLearning

eLearning can be viewed from two angles, namely from the point of view of ICT enhanced (evolutionary technological change) education system and from the point of view of an instrument that strives to bring about a paradigm shift (revolution) in learning. The initial notion underscores learning, as part of the overall socio-economic, political and cultural spheres in which it has continuously integrated technology use. Thus, technology is a teaching aid, subordinated to the pedagogy, but also brought an evolutionary change. Rapid development of technological infrastructure is one of the driving forces behind eLearning, to which, eLearning is also posing greater impacts on the pedagogy system. Therefore, it is admissible to real the concepts behind eLearning and the impacts on the education system of each society.

2.2.2.1 Conceptual Definitions

The concept eLearning can be conceived either as an education system supported by Internet or as quite a complex education system difficult to define. This is mainly because the prefix 'e' is understood and interpreted by many in various ways depending on the purpose of definition. Some of the commonly observed definitions eLearning in literature are enlisted as follows.

- It is application of ICT in education [32]
- It is an online access to learning resources, anywhere and anytime [13]
Technology-enabled learning that embraces a range of electronic media [47]
- It is about the use of the Internet to access learning materials; to interact with the content, instructor, and other learners; and to obtain support during the learning process, in order to acquire knowledge, to construct personal meaning, and to grow from the learning experience [48]
- It is about the use of Internet technologies to create and deliver a rich learning environment that includes a broad array of instruction and information resources and solutions, the goal of which is to enhance individual and organisational performance [5]

Hence, eLearning embeds dynamically and continuously changing technological infrastructure, i.e. Internet, and the ever widening and complex learning system. In this

connection Holmes and Gardner [13] underpin the 'endless development of eLearning' as with today's eLearning technological infrastructure development, such as the nano-technologies, the semantic grid and emerging communal learning tools such as wikis, blog, etc., that the future will provide anywhere (mobile and ubiquitous) and anytime online access for every society to an almost inconceivable huge knowledge and learning space.

Therefore, providing a single and a universally accepted definition of eLearning is difficult. Alone, the way it is written is as diverse as it may pose difficulties for compiling references or sensitive-case searches. This shows that the problems of a universally accepted definition of eLearning.

In a nutshell, though, the fact that prefix "e" may not necessarily alter the whole theories of learning, but it is also true that technological advancement and technology use in education and impact on the overall system, persuades the traditionally well established learning theories to cope up with the newly prevailing phenomena. In line with this, there are different notions, such as groups who want to overtake the existing learning theories, while others argue to solely integrate, flexibly and adaptable theories so that the ever-growing advancement in educational technologies shall be wisely treated.

Two cases can be mentioned in related to the discussion on eLearning and learning theories. The first argument is that ICT use is influencing learning theories in many ways. As the reflections are seen in changes in instruction / curriculum developers, education service providers (teaching / mentoring staff and management group), policy makers, etc. ought to be aware of how to integrate ICT in the education system to enhance better education results. For instance, Mayer [49] remarks the role of theory of learning has to do with multimedia design by proposing three assumptions of cognitive theory of multimedia learning, namely:

- Dual channels: Humans possess separate channels for processing visual and auditory information
- Limited channels: Humans are limited in amount of information that they can process in each channel at one time
- Active processing: Humans engage in active learning by attending to relevant incoming information, organizing selected information into coherent mental representations, and integrating mental representations with other knowledge

The second argument was that eLearning is in no way different from learning, and coupled with that there are really no models of eLearning per se - only eEnhancements of models of learning [35]. Therefore, the relationship between the two implies that eLearning design connotes two separate sets of decisions, based on a learning theory articulated as a pedagogical framework, as Ciaffaroni [50] emphasizes the implicit assumptions about technology and a set of pragmatic decisions, such as the ones related to *efficiency/effectiveness*, or *costs*, or *quality/assurance*.

In a broader sense, eLearning is used to describe the way people use an electronic device (usually a computer) with learning technology [51] to develop new knowledge and skills individually or collaboratively new forms of mobile technology containing additional sensor devices have been providing new directions for technology-assisted learning, and this has led to context-aware ubiquitous learning [52], which enables users to interact and learn with sensors and radio frequency identification (RFID) embedded objects in their surroundings [53]. Context-aware ubiquitous technology is continuing to develop and spread, and its applications have begun to influence learning in various fields and disciplines [54].

Yet other conceptual issues subject to discussion in line with eLearning are:

- Technological infrastructure⁵.
- The globalisation and cross-cultural issue that eLearning openly advocates. Cross-cultural or intercultural issues are much more challenging in today's global education system than ever before. Cultural issues are crucial when it comes to content development, languages, facilitation, and collaborative or group learning.

2.2.2.2 Standards and Specifications

Following the conceptual definitions of eLearning effort was made to association the concepts with prevailing standards⁶ and specifications⁷ widely use in practice. Stan-

⁵This issue is discussed separately hereafter under the topic eLearning technologies and eLearning environment.

⁶A standard is a recognized technology, format or method that has been ratified by a recognized standards body, e.g. international bodies (ISO & IEEE); national bodies (BSI)

⁷Specifications have not been ratified by official bodies, but can be useful as de facto standards in the interim between identifying a need, and the relevant standard being ratified, e.g. IMS.

dards and specifications of eLearning are set by major players in technological infrastructure and application development. eLearning content developers, service providers and policy making institutions refer to well established and broadly applied (tested) standards and specification.

Major drivers and stakeholders in eLearning standardisation and specifications are:

- The Institute of Electrical and Electronic Engineers (IEEE) Learning Technology Standards Committee(LTSC) - A multi-part Standardization institute has developed Learning Object Model (LOM) to facilitate search, evaluation, acquisition, and use of learning objects, for instance by learners or instructors or automated software processes [55]
- The Sharable Content Object Reference Model (SCORM)- It is a standard developed by the Advanced Distributed Learning (ADL) consortium⁸ for purpose of packaging and deployment of Web-based learning objects⁹ which are relatively small, reusable resource, through which a coherent, identifiable piece of learning can be achieved [56]
- The Instructional Management System (IMS) Global Learning Consortium (GLC): This is a global organization that strives to enable the growth and impact of learning technology in the education and corporate learning sectors worldwide; through development of interoperability and adaptive standards learning and educational technology, more specifically, in content and learner information packaging, question & test interoperability and simple sequencing
- The Centre for Educational Technology Interoperability Standards (CETIS): CETIS facilitated by the JISC, whose basic mission is to help institutions, main in UK, develop and implement open standards-based flexible and adaptive learning environments, learning services and learning resources [57]

Although there are different standardization and specifications institutions, their major objectives are focussed on:

- Ensure that educational content reusability

⁸Though, the individual components come from a variety of sources. One of the main contributors is the IMS (Instructional Management System) project

⁹ defined by Bob Banks

- Enhance sharable content & learner information
- Facilitate interoperability and adaptability
- Devise educational scenarios and formulate instructional design
- Deliver educational content tailored to learners' requirements

In line with this development eLearning services and the technological infrastructure have been influenced by standards and specifications. Nonetheless, currently available standards and specifications have their limitations to be applied as the newly emerging situations with eLearning and the requirements are surpassing what the existing standards and specifications can accommodate.

All in all, the science of eLearning is from the point of view of pedagogical aspects, less dynamic while from the point of view of technological infrastructures and standards changing rapidly to which it requires adaptability to the prevailing socio-economic and technological level of development of a given society. Moreover, eLearning needs to be understood as a complex socio-technical network of actors with differing interest but co-exist to attain mutual goals.

2.2.3 Actor Network Theory

Actor-Network-Theory (ANT) is a conceptual frame for exploring collective socio-technical processes [58], as well as an analytical tool that attempts to integrate technology into social processes [31]. Initially, ANT was developed as an analytical tool by Bruno Latour [59], Michel Callon [60] and John Law [61] distinguished from other network theories in that an actor-network contains not merely people, but objects or technological metaphors including computer software, hardware, and technical standards, and organizations. Thus, the primary tenet of ANT is the concept of the heterogeneous network- a network containing many dissimilar actors. Purpose of development of ANT was to model the success or failure of technological innovations, and as a means of studying the evolution of scientific and technological communities [62].

Recently, however, ANT is also used in researches in information technology system mainly concerned with the creation and maintenance of coexisting networks of human and nonhuman elements; include people, organisations, software, computer and communications hardware and infrastructure standards [60]. The objectives underlying

in the discussion about ANT is, by way of highlighting the concepts and features of ANT, to underline the potential role this analytical theory plays in research in eLearning.

2.2.3.1 The Concept and Features

The main concept of ANT is the idea of actor-network tries systematically analyses the relationship and purposeful coexistence among various human and non-human actors. Callon [31] underpins that the ANT as actor-networks that also are potentially transient, existing in a constant making and re-making. This means that relations need to be repeatedly "performed" or the network will dissolve. On the other hand the networks of relations are not intrinsically coherent due to the heterogeneity of actors and differing interests [31].

Actors and networks are mutually constitutive, meaning that there is no actor without action; that is, relationship with other actors, and the network is built on the mutual influences and intermediaries that actors exchange between each other. Actors in ANT are not only humans, but also nonhumans [63].

Therefore, central to ANT is the argument that agency is distributed among all actors, not only human, but also non-human actors [64]. Features of ANT could be best revealed by set of ideas developed both in theoretical and empirical studies which share the premise of the inseparability of the social and the technological. Moreover, ANT, as a conceptual framework developed and used to explore collective socio-technical processes [58], attempts to integrate technology into social processes [31]. Under-scoring the basic features of ANT, Tatnall and Burgess [65] argue that while many approaches to research in technological areas treat the social and the technical in entirely different ways ANT proposes instead a socio-technical account in which neither social nor technical positions are privileged. This conforms with Latour's [59] assertion that ANT deals with the social-technical divide by denying that purely technical or purely social relations are possible, and considers the world to be full of heterogeneous entities containing both human and non-human elements.

All in all, basic features of ANT and reason to use this theoretical framework are:

- ANT advances methodological principles of generalized symmetry, employing a single explanatory frame when interpreting actants, human and nonhuman.

That is the interaction among the facilitators, eLearners and the LMS will be a justifiable

- ANT focuses on the actor-network, that is, the persons and things that play a role in the adoption process and their interactions and mutual influences. This symmetric view of people and things as taking place in a network of interactions is especially meaningful in eLearning where people, technology, models, and activities interact strongly to produce a new way of considering learning [63]

Actor network theory is also built on the following basic concepts [63]. These are:

1. Translation is a sort of agreement actors in the network reach and a protocol that states basic agreed issues. In this regard Michel Callon [31] has defined 4 moments of translation, such as:
 - Problematisation: is identifying and defining the problems to be commonly defined
 - Interessement: Getting the actors interested and negotiating the terms of their involvement. In this case, an actor, (mainly the primary actor) tries to convince the other actors that the roles it has defined them are acceptable
 - Enrolment: Accepting roles defined during interessement
 - Mobilization: playing active role by performing the delegate actors in the network

Translation means you have to translate actors and actors' interests in order to enrol actors in the actor-network. It is a negotiation process. It means that a shift is necessary, from the part of all actors, to understand others' interests and how they could work together to reach a common goal. For example, this can be easily experienced in group-work. Negotiating the subject of the group-work, the schedule, the collaborative tools that will be used, may seem to be a waste of time at the beginning of a project. But, it is a way to build a strong actor-network for such an activity, and time might be well saved in further steps [63].

2. Intermediaries and Mediators: The distinction between intermediaries and mediators is one of the key issues addressed by ANT and quite vital for the overview of the role of actors identified in our thesis. Intermediaries are entities which make no difference and can be ignored. In this case it could be the LMS,

i.e. eLearners and eFacilitator can communicate and interact with other media rather than using LMS.

3. Principles of Generalized Symmetry: The basic feature of actor network theory incorporates what is known as a 'principle of generalized symmetry'; consisting of human and non-human actors integrated into the same conceptual framework and assigned equal amounts of agency [31] [66].
4. Actants: ANT defines, for instance, actants to denote human and non-human actors, and assumes that actants in a network take the shape that they do by virtue of their relations with one another. It assumes that nothing lies outside the network of relations, and as noted above, suggests that there is no difference in the ability of technology or humans or non-humans to act. As soon as an actor engages with an actor-network it too is caught up in the web of relations, and becomes part of the 'entelechy' [63].
5. Punctualisation: If taken to its logical conclusion, nearly any actor can be considered merely a sum of other, smaller actors. In this regard, each actor in our actors' network is built up from a network of actors, which in effect is that the network of actors is a network of diverse networks [63].

In general, as Tatnall and Burgess [65] argue that an actor is seen not just as a 'point object' but rather it is as an association of heterogeneous elements, where these elements are themselves constituting a network, to which, each actor is itself also a simplified network. Besides, in ANT interactions and associations between actors and networks are vital phenomena, and actors are seen only as the sum of their interactions with other actors and networks [65].

2.2.3.2 ANT in the Context of eLearning

This thesis argues that eLearning is upheld and driven by a heterogeneous socio-technical network of actors, rather than mere technology. Major actors in this case are technological infrastructure, educational organisations and eLearning societies need to be studied from the point of view of ANT.

Accordingly Esnault [63] argues that, various actors are taking part in eLearning such as in content development, course delivery, facilitating communication among

stakeholders and learning process. One particular example that can be cited is the learning management system (LMS) in the eLearning system. The LMS can be viewed as a socio-technical network that constitutes the technical infrastructure at learners' homes as well as on the institution campus, the multimedia tools, the collaboration facilities (if any) among others, teachers, learners, and other human stakeholders could be considered as actors. According to Esnault [63], even more.

By-and-large, many of the features of the ANT are suitable to the research undertakings in eLearning. One of the features is the '*Principles of Generalized Symmetry*' which defines the heterogeneous complex socio-technical actors in eLearning, i.e. eLearners (people), the eLearning technological infrastructure (technology or more specifically, the LMS, LCMS, etc.) and the educational organisation. These actors interact among themselves strongly to produce a new way of technology enhanced learning [63]. Being able to comprehensively identify all these stakeholders, take their diverse interests into account, and try to align at least some of these interests along common goals (what ANT calls 'building the actor-network') is a key step in the success of an eLearning development [63].

Towards this end, one of the features of ANT is translations—a process where all actors agree as well as enable themselves to serve their interest at best. This can be revealed by establishment of online learning groups and "achieve higher-order learning activities" [63], for all participating actors, say, for the instructors as well as for the learners. Moreover, for interaction (collaboration, collaborative tasks, asynchronous and synchronous exchanges), where the content of the course (learning) material, defined tasks, assignments, etc. are crucial in the process enrolment of actors to build the online community actor-network.

Esnault [63] further argues that the learning process is theorized from the perspective of ANT and the socio-cultural theory of tool construction and use. The software mediates the organization's memory and newcomers learn the software's social utilization scheme.

Coupled to that, a cautious study and analysis have been made on the complexity of the network of actors posed by steadily changing functional relationship¹⁰ joint and the socio-technical behavioural and the methodological approach to disclose the

¹⁰By functional relationship we mean the relationship of actors aimed at performing joint tasks. For instance the function of LMS is to provide a platform of communication for eLearners and eFacilitators.

magnitude of the impact on eLearning role. Functional relationship among actors poses not only division of responsibility areas, but also power of the relationship. The power relationship can be a harmonious (complementary) and/or proponent (substitute) role, so that it could be possible to keep the balance between weaker and stronger resource may be weaker than the other. Bases on the ANT basic features, actors have different interests.

2.3 Critical Success Factors (CSF)

The concept CSF was initially proposed by Rockhart [67] as early as 1979, and subsequently widely used in the world of data analysis, and business analysis [67] to identify factors that are required for an organisation to survival and success, and applied in various settings. Moreover, CSF have been applied in various researches to bestow special focus; to identify and set the magnitude and duration of the effects of CSF and develop good measures for those factors and to seek reports on each of the measure [67].

In line with this notion, this thesis has attempted to identified and define relevant critical success which are crucially vital resources to enhance a sustainable eLearning in the context of DCs. Thus, CSF as a subject of investigation deals with the relationship and impact of key features of individual actors within the overall complex actor network. In order to closely assess the CSF of eLearning in DCs, this part of the thesis has begun to define the concept CSF in the context of DCs and thereafter has elaborated few selected CSF.

In line with this, the thesis, which are the foundation of the framework of the research. The CSF are more or less features of the socio-technical actors.

2.3.1 Concepts in the Context

In general CSF for eLearning are defined as the basic elements that are required to maintain and sustain eLearning development. Identifying CSF for eLearning is as setting explicitly the strategic development and fixing required resources. This is indeed on of the challenges most eLearning organisation are confronted with among many eLearning organisational challenges [68].

Subsequently, effort is made to highlight the features, impacts and interrelationships among the CSF and the overall network. The CSF selected discussed in this thesis are classified into two main categories, namely factors related to the eLearning environment and eLearning process. The eLearning environment comprise to the technological infrastructure (the Internet connectivity in particular). The eLearning process factors consist of the eLearners' activities (learning strategies, patterns, performances, etc.) that are more or less traceable to individual eLearners. This thesis broadly categorizes the self-efficacy to effectively use the eLearning environment and learning in group, and providing reflective feedback using ePortfolio on the eLearning environment as a an eLearning process. Brief overview of the eLearning environment and eLearning process are discussed here below.

2.3.2 Technological Infrastructure for eLearning

The term technological infrastructure comprises to quite broad composite concepts that change from time to time with the advancement of technology use in the education system. Carliner and Shank [6] refer to learning technological infrastructure as the components of hardware and software vital for learning materials development, deliver, manage (accessing, eFacilitating, exchanging information and feedback, etc.) learning and communications.

Technological infrastructure refers to the configuration and adequacy of technology (software, hardware, and bandwidth) within a learning environment [69]. The hardware parts of technological infrastructures for eLearning are the server at the provider side and the set of devices (PCs, laptops, workstations, etc.) at the side of the end users and the Internet connectivity. The software (application systems) can be equated to what is mainly known as a learning management system [70] or simply learning platform which is a conglomeration of several application tools to effective manage eLearning. On the other hand, Brandon Hall [71] defines learning environment as software designed as an all- in-one solution that can facilitate online learning for an organization, with functions of managing courses and providing an interface that allows students to register and take courses.

Depending on the mode of delivery and facilitation (online, face-to-face, blend of both), resources related with eLearning environment, such as the LMS are not only vital, but also part to set the requirements of eLearning organisation shall set as a

central focal point in the strategic plan. In the DCs, where the technological resources are scarce, it is quite vital to define and assess the prevailing technological infrastructure for eLearning at the very outset as well as in due course of time as it may dynamically change.

To this end, the eLearning environment is mainly featured, but not exclusively, by the Learning Management System (LMS) synonymously used with the concept eLearning platform within the technological infrastructure consisting of various (heterogeneous) tools.

The eLearning environment is a complex technological infrastructure system that encompasses technological infrastructure where eLearners and eLearning service providers communicate, interact and acquire resources for learning. In other words, the LMS is part of the implement eLearning to which learning resources such as learning and tutorial materials, assignments, discussion fora and collaborative tools, eLearners personal records and information repositories, etc. are realised. In short, as Holmes and Gardner [13] confer, LMS as an eLearning environment provides an integrated set of tools [and infrastructures] to support learning through the basic software application that automates the administration, tracking, and reporting of training events. Hence, Ellis [72] advises that an LMS should be able to do the following:

- centralize and automate administration
- use self-service and self-guided services
- assemble and deliver learning content rapidly
- consolidate training initiatives on a scalable web-based platform
- support portability and standards
- personalize content and enable knowledge reuse

The eLearning environment facilitates communication, content delivery, assessment and interaction with [73].in this connection, McPherson [74] see the strategic functions of learning environment from the point of addressing an identified learning need and resolving a particular educational problem, particularly associating it to strategic needs of the eLearning services provided by the institution. Moreover, McPherson [74] further elaborates that learning environments are essentially constructs that promote

learning by supporting interactions between, the tutor, the learner and her/his peers, the subject matter, and the learning materials.

Coupled with this, Nunes and McPerson [68] underline in a broader sense that eLearning technologies are comprises to virtual learning environments or as managed learning environments as well as to the computer mediated communication and specific teaching and learning tools. Thus, learning environments are essentially constructs that promote learning by supporting interactions between, the tutor, the learner and her/his peers, the subject matter, and the learning materials. Moreover, according to McPerson [68] and Rosenberg [5], the LMS shall also provide the following functions:

- Online course catalogue
- Online registration system
- Management of learning materials
 - Course Materials
 - Case-Studies
 - Links to relevant Web Sites
- integrating information resources
 - Learning Activities
 - Individual Learning Activities
 - Group Learning Activities
 - Assessed Activities
 - Explicit Learning Materials

2.3.3 Self-Efficacy to Internet Use (ISE)

Researchers [75] have pointed out that an appropriate use of Internet-based instruction concurs with the constructivist pedagogy, that asserts learning as actively constructed by individual learner and the construction process which is highly influenced by the learner's prior knowledge, student negotiation and the cognitive apprenticeships. A successful implementation of Internet-based learning requires a thorough study about

students' perceptions and preferences toward the technological infrastructure and the eLearning environments. Thus, constructivist pedagogy gives due emphasis to the importance of Internet-based learning environments [75].

As previously discussed this thesis proposed that eLearners Internet self-efficacy (ISF) is one of the decisive CSF for eLearning in DCs. This chiefly because eLearners ISF is paramount to promote sustainable eLearning, as many studies underscore the close relationships between student Internet self-efficacy and eLearning performance. Therefore, this thesis highlights the concept ISF and its impact on eLearning.

The Concept Self-efficacy

Bandura has defined self-efficacy as the belief in ones ability to succeed in specific situations [76]. Self-efficacy plays major role in approaching challenging goals or tasks which emphasizes the role of observational learning and social experience in the development of personality. Therefore, according to Bandura's social cognitive theory, people with high self-efficacy, such as those who believe they can perform well, are more likely to view difficult tasks as something to be mastered rather than something to be avoided.

Bandura's [77] emphasis that one's mastery experiences are the most influential source of self-efficacy information has important implications for the self-enhancement model of academic achievement, which contends that, to increase student achievement in school, educational efforts should focus on altering students' beliefs of their self-worth or competence. Social cognitive theorists shift that emphasis and focus on a joint effort to raise competence and confidence primarily through successful experience with the performance at hand, through authentic mastery experiences. They argue that interventions should be designed accordingly.

Self-efficacy and eLearning

Self-efficacy is, from the point of view of learning theories and eLearning a vital concept to be studied. Most particularly use of the computers and the diverse and complex functionalities of the Internet environment for learning is challenging for learners who may only have access for limited time, such as in DCs. Saad and Kira [78] report that the use of computers still has some unpleasant side effects, such as computer anxiety influences how users perceive ease of use of an information system, despite the Internet boom in the past decade. In line with this, their investigations confirmed the influence of computer anxiety on perceived ease of use and the mediating

effect of computer self-efficacy on this relationship, within an eLearning context, and concluded that self-efficacy is determined by levels of anxiety such that reduced anxiety and increased experience improves performance indirectly by increasing levels of self-efficacy [78].

Internet self-efficacy's broad application across various domains of behaviour has accounted for its popularity in contemporary motivation research, for which Graham and Weiner [79] explain that what the most influential source of these beliefs is the interpreted result of one's purposive performance, or mastery experience.

Simply put, individuals gauge the effects of their actions, and their interpretations of these effects help create their efficacy beliefs. Outcomes interpreted as successful raise self-efficacy; those interpreted as failures lower it.

Moreover, self-efficacy is self-regulation and self-critical assessment that are also vital for eLearning process and goal oriented learning. A learner's independent assessment of self-regulated learning ability which is-regulatory efficacy is a systematic management process that is in connection with one's own thoughts, emotions, and behaviour regarding one's personal goals and achievements [80]. The relationship between self-regulation and self-learning goal need to be conceived in order to develop, revise, and complement the learning strategy via self feedback. The learner must make a constant effort to sustain learning motivation [81].

In a nutshell assessing and continuously determining self-efficacy of Internet use for eLearning as well as group-based or collaborative online processes are consideration as critical success factor for eLearning in DCs. In other words, self-efficacy to eLearning could be also assessed in the use or not use of the Learning management systems, as problem that might not necessarily have to do with connectivity problems. According to Saad and Kira [78] LMS, several studies, have pointed out that factors relating to 'ease' with which information can be found on a web site and the 'ease' with which information can be understood affect web site's perceived ease of use.

2.3.4 Group-based eLearning

Learning takes place within a social context, as it has long been argued by the social constructive learning theories [82]. When it comes to online or virtual learning, which is characterized by separated location between teaching and learning bodies, students

will be easily frustrated. Hence, in order to close the gap created by the distance as well as to facilitate effective communication and interaction, group-based online learning teams shall be systematically organised.

The environment in which interaction among students takes place, plays a central role [82]. The benefits of online collaborative learning, sometimes referred to as CSCL (computer-supported collaborative learning) are compelling, but many instructors are reluctant to experiment with non-conventional methods of teaching and learning because of the perceived problems [82]. In this regard, Roberts and McInnerney [82] defined seven interrelated problems in group-based online learning, that are thought to be inherent to this method of teaching, the seven most commonly found in the literatures, as follows:

- Problem 1: Student antipathy towards group work or group-based learning—Some students do not care for the idea of group work and can be apathetic, or even on occasions actively hostile to the whole idea
- Problem 2: The selection of the groups—difficulty of arranging groups and suitable times when all group members can meet outside of scheduled sessions
- Problem 3: A lack of essential group-work skills—Simply placing students in groups and telling them to work together does not in and of itself result in cooperative efforts
- Problem 4: The free-rider-students in the group do little or no work, thereby contributing almost nothing to the well being of the group, and consequently decreasing the group's ability to perform to their potential
- Problem 5: Possible inequalities of student abilities
- Problem 6: The withdrawal of group members, attrition and withdrawal because of feelings of isolation
- Problem 7: The assessment of individuals within the groups—traditional view of assessment is not potent

On the other hand, the challenges will be more severe when there are problems in the communication and interaction environment. With all above mentioned problems, group-based online learning will be vital in the sense that eLearners will benefit not only from learning in group for that specific course, but they will benefit a lot in several

way. Levin and Kent [83] enlisted that, when it came time for them to partake in real world employment, students involved in group learning would have developed the skill to:

- develop rapport with others
- negotiate a framework for working with others
- generate and sustaining motivation and commitment to working together
- stand back from the hurly-burly of teamwork and
- make sense of what is going on in one's team
- cope with stressful situations that arise
- evaluate the working of one's team
- recognise and making the most of individuals' dispositions to prefer particular team roles
- build up one's teamwork expertise

Thus, group-based online learning is one of the CSF, to which eLearning models shall take care of integrating eFacilitating services and design the learning management system.

2.4 ePortfolio use in eLearning

With a paradigm shift in the education strategy towards self-regulated reflective and participatory learning, ePortfolio are advancing in similar directions by virtue of sharing related resources and environment. In many cases, it has become plausible that ePortfolio is part of the pedagogical strategy of eLearning. In this relation, Cott [84] argues that configuring eLearning at a higher level to ensure that ePortfolios are embedded in ways that are meaningful for both learners and other stakeholders, and to maintain flexibility, given that demands on the portfolio are likely to change as pedagogic and policy requirements is quite important.

ePortfolio use in education is becoming fashionable in schools for several reasons, such as for instance, for profiling students' learning development as well as a learning and assessment tool which also has particular application to higher educational

contexts [85]. Moreover, ePortfolio provides an effective framework for connecting both higher-order and 'competency' modes of the learning process with assessment in both the formative and summative senses [85]. ePortfolio promotes learning as an activity-reflection cycle leading to more effective and applied connections between theory or procedures and practice (and various other related top-down vs. bottom-up imperatives of education) [85].

2.4.1 The Concept

The concept ePortfolio is defined in various ways by several institutions and experts based on specific goals (i.e. as a collection tool, as evidence or reflection on journey). Commonly quoted definition of ePortfolio states the concept ePortfolio is defined by National Learning Infrastructure Initiative (NLII) [86] as: "a collection of authentic and diverse evidence, drawn from a larger archive, representing what a person or organization has learned over time, on which the person or organization has reflected, and designed for presentation to one or more audiences for a particular rhetorical purpose. Another widely used definition of ePortfolio states that an ePortfolio is as "a collection of authentic and diverse evidence, drawn from a larger archive, that represents what a person or organization has learned over time, on which the person or organization has reflected, designed for presentation to one or more audiences for a particular rhetorical purpose" [87] [88]. Yet, an ePortfolio is defined as a digitized collection of artifacts including demonstrations, resources, and accomplishments that represent an individual, group, or institution.

In sum, ePortfolio is commonly, understood as a tool used assessment, accreditation, reflection, student resumes and career tracking or it is a tool used to collect and process a showcase or personal development plan. This collection can be comprised of text-based, graphic, or multimedia elements archived on a Web site or on other electronic media such as a CD-ROM or DVD. Another argument in this line is that ePortfolio shall be viewed more than a simple collection it can also serve as an administrative tool to manage and organize work created with different applications and to control who can see the work ePortfolios encourage personal reflection and often involve the exchange of ideas and feedback. It is also stated that ePortfolios have been emerged as a valuable online tool that learners, faculty, and institutions can use to collect, store, update, and share information.

As epitomized by influential concepts such as flexible delivery and life-long learning, the educational implications of ICT have been recognized by many as learner-centred or constructivist. The ePortfolio model recognizes that such implications are dependent on the 'pedagogical' design of effective learning in terms of an activity-reflection cycle.

The activity-reflection ePortfolio might thus be applied to a range of different types of learning. Underpinning the emphasis on reflective practice and the process of learning is a key notion that ICT represent a mode of literacy with new media or tools of learning [85].

The ePortfolio has further been outlined above as a convergent hub also for a series of related notions linked to a view of the constructivist or learner-centred implications of ICT in education (project-based learning, authentic assessment, collaborative learning, etc.). The key to such a hub of convergence, it has been suggested here, is the pedagogical design of reflective practice in terms of a threefold process of naive doing, critical thinking, and applied performance and knowledge [85].

2.4.2 Type and Functions

The types and functions of ePortfolio are in as much diverse as the definitions. Van Tartwijk, and Driessen [89] argue that when talking about the use of ePortfolios, it has become extremely important to mention the type and the purpose that the portfolio is used for, otherwise the discussion might start with wrong premises. Summing up the variety of functions and types of ePortfolio, effort is made to classify most common types into three major categories. These are

- **Developmental Portfolios:** Demonstrate the advancement and development of student skills over a period of time. Developmental portfolios are considered works-in-progress and include both self-assessment and reflection/feedback elements. The primary purpose is to provide communication between students and faculty.
- **Assessment Portfolios:** Demonstrate student competence and skill for well-defined areas. These may be end-of-course or program assessments primarily for evaluating student performance. The primary purpose is to evaluate student competency as defined by program standards and outcomes.

- **Showcase Portfolios:** Demonstrate exemplary work and student skills. This type of portfolio is created at the end of a program to highlight the quality of student work. Students typically show this portfolio to potential employers to gain employment at the end of a degree program.

Besides, there is also a fourth category which is a hybrids of the three types of portfolios listed above. This is mainly because there are not ePortfolios strictly used for assessment, development or showcase purposes, that do not show evidence of self-reflection, rubrics for assessment or feedback. Self-reflection is an important component of electronic portfolio development. If you do not require participants to self-reflect on the artifacts they add to the portfolio, they will not gain from the rich learning experience that ePortfolio development can provide!

The focus of this part is on ePortfolio-based reflective learning that heavily leans towards experiential learning theory, particularly Kolb's [41] concept of the 'learning cycle'. and various constructivist or student-centred implications of new learning technologies. Learning only takes place if students reflect on that experience, conceptualize new 'rules' for action based on their experience and reflection, and then test those rules in another concrete situation.

Moreover, ePortfolios can be linked to the following cross-curricular competencies as Abrami and Barrett [90] state:

- **Intellectual Competencies**—encouraging students to interact and work together to use information, to solve a problem, to exercise critical judgment and to use creativity
- **Methodological Competencies**—motivates students to be self reliant in selecting appropriate means for attaining objectives, to analyze the way they use available resources, and to evaluate the effectiveness of their work methods
- **Personal and Social Competencies**—encourages students to exchange points of views with others, to listen and to be open to differences and to adapt their behaviour to the social context of learning as well as work collaboratively in an intercultural environment

Grahm [91] also views the different pedagogic processes in use of ePortfolio. In this connection, he tried to map the functions of ePortfolio onto the pedagogy, as follows:

1. Recognizing Learning. With use of ePortfolio, life-long and life-wide in formal and informal learning, students can release and recognise their learning
2. Recording Learning. An ePortfolio allows learners to record their learning and formal achievements
3. Reflecting on learning. ePortfolios are growingly used to include reflection (the most important part of the learning process) from learning and on learning
4. Validating Learning. Learners can provide evidence of learning by including their learning processes and performance in their Portfolios
5. Presenting Learning. Learners can select from their repository of artefacts and present or publish it to public
6. Planning learning. Learners are motivated to plan as well as reflect on past experiences (tasks performed)
7. Assessing Learning. Assessing is an external process, not under the control of the learner. Assessing is external judgment of the value of a set of artefacts presented by the learner

In this regard, Bereiter and Scardamalia [92] argue that ePortfolios encourage the pursuit of personal cognitive learning goals, what they call it as 'intentional learning'. Moreover, portfolios prompt students to look back, to digest and debrief, and to review what happened so that they can set new goals and determine next steps. In an attempt to demonstrate the effects of reflection, Sweidel-Gabriele [93] asked students self-reflective questions about their study strategies and found that at the end of the semester they were able to identify relationships between the process and the outcome of their studying. The learner's reflections are the rationale that specific artefacts are evidence of achieving the stated standards or goals [94].

Zimmerman [95] also noted that ePortfolio may be linked to a student's ability to self-regulate their learning and to enhance their meaningful learning of important educational skills and abilities. Self-regulated learners are individuals who are meta-cognitively, motivationally, and behaviourally active participants in their own learning [96]. ePortfolio, by virtue of being a tool to collect information on learning process and achievements over longer time, will be helpful to trace the personal development.

Several researchers and experts such as Abrahamic, Wade and Sclater [97] stress on the use of ePortfolio as effective tool to provide an alternative form of assessment. This gives weight to formative assessment by moving away from the most customarily used summative assessments. Such assessments as Abrahamic and Barrette [90] dispute that it is more 'authentic' as they rely on more than one piece of evidence, while indicating the development of thinking and representing students' ability more accurately.

Butler [98] discusses the concern about using ePortfolio to assess students learning by tracing McMullan et al [99] opined on similar issue, "the conflict inherent between assessment use and learning use of portfolios. Knowing that their work will be assessed may impact on what evidence students choose to include, and may also affect the experiences and perceptions of the benefits to themselves of portfolio use reasons out why use of ePortfolio builds learning culture, as a longitudinal view of student's work provides a picture of growth, progress and continuity over time and because portfolios provide assessment based on evidence of individual student's effort- not a list of test scores [98].

2.5 ePortfolio as a Feedback Repository

2.5.1 Feedback Concept and Context

Feedback is also one of few critical success factors, which enhances active participation based on reflection. In order to clarify feedback's role we commence on defining the concept and the features. The term feedback is defined as "the return to the input of a part of the output of a machine, system, or process, or as the transmission of evaluative or corrective information to the original or controlling source about an action, event, or process the information so transmitted"¹¹. Besides, Lou, Dedic and Rosenfield [100] state feedback as: "Informational message sent by one element of a system to other elements, with the expectation that the receiving element will use this message to modulate its performance".

Although the concept feedback varies greatly depending on the subject matter and the field of study under discussion, we stick to the use of feedback as "a central function in

¹¹Source: Merriam-Webster's dictionary

learning” and indeed, where a bi-directional flow of information (including reflections) prevails—from learners to and/ or from services providers (tutors, instructors, system service support). In this thesis, we also consider feedback as information the user or a sender receives from her/his peers, eFacilitators, or others directly involved in the learning system.

Reflective is meant simply 'relating' or 'deeply thought'¹² on ones experience. Reflective Feedback could also be seen as critical view while supplying feedback. Feedback in an online learning environment is crucially important. Online learners, who are distributed and probably do learn virtually will get left alone and be sooner or later frustrated.

On the other hand, feedback reflects one's perception or thought on the subject under discussion. This means, feedback is to a certain degree reflective. Yet, feedback in online learning is a process which is done regularly. In general, the importance of reflective feedback in education has been recognised as vital and it is seen that due emphasis is being given from different perspective; especially in adult distributed collaborative life-long and life-wide learning system.

A model of self-regulated learning is proposed as a structure for analyzing cognitive processes involved in self-regulation and for interpreting findings from disparate research traditions. The model is used to examine recent research on how feedback affects cognitive engagement with tasks and the relationship between engagement and achievement [101] [102].

Feedback can be classified based on the source, timing, use or purpose. Besides, it is also dependent on the fields of applications which the feedback is in discussion. In some literatures [103] [100], we find that the type of feedback is classified as positive or negative feedback. Positive feedback seeks to increase the output that caused it, as in a nuclear chain-reaction. This is also known as a self-reinforcing loop (often used in nuclear, behavioural or medical science) [103]. On the other hand, negative feedback seeks to cancel the output that caused it, as in a thermostat-controlled heater. This is also known as a self-correcting or balancing loop [103]. In this connection the negative feedback in an online learning holds back participation. The negative feedback loop tends to slow down a process, while the positive feedback loop tends to speed it up [103].

¹²The Free Dictionary

However, according to Seng [103] a positive feedback loop does not necessarily have a positive effect, since the name refers to only the nature of change rather than the desirability of the outcome. Furthermore, Senge [103] argues that positive and negative do not mean or imply desirability, but the positive-negative dimension measures the degree of optimism or pessimism in the contents of the response given by the receiver to the sender.

On the other hand, Lou, Dedic and Rosenfield [100] classify feedback on the basis of participants, as in the feedback chain or flow:

- Student feedback: Feedback given to individual student
- Author feedback: Feedback given to an author
- Group feedback: Feedback given to a group or team

Burtel and Wennie [104], reviewing and elaborating contemporary models of feedback functions and self-regulated learning, classify feedback as internal (self-reflection) and external (evaluation or feedback given by others).

2.5.2 Feedback in eLearning

Feedback in eLearning may emanate from external or internal sources [100] [104]. The internal comprises to feedback generated during students' own cognitive process of monitoring while the external encompasses the feedback from teaching staff, from peers or others. Internal feedback can be, for instance, what is performed by the student themselves, while external may be generated by person/persons other than the students themselves [105], i.e. the facilitators, peers, etc.

Most prevalent and crucially important to use feedback in education will be, in case of distance mode of education, where teaching staff and learners are physical separated. In the case of traditional distance education, communication between teaching staff (facilitators) and learners is very limited, due to the nature of the education.

In case of online learning, however, there is various communication media integrated in the learning environment. The question is merely accessibility, capacity and affordability. Moreover, participants of distance and online learners have obviously heterogeneous background, such as differing working time, language and ICT related

competencies, cultural, etc. In fact, with the twenty first century rapid technological development and diffusion, even in peripheral regions too, communication and interaction is under continuous improvement, where problems also connectivity and access will slowly dwindle. Capturing feedback from the communication (such as log files, email and discussion fora) boosts feedback resource.

Feedback use in education may need not only simply embedding the feedback in the curricula, but also a paradigm shift towards active participation of actors, both learners and teachers, and critical thinking to be enabled to provide reflective feedback. In this case, from the cognitive perspective, feedback throws light on individual learning objectives [105], where the outcomes and the qualities of the cognitive processing can be viewed as the effectiveness of feedback. Moreover, both constructivists and behaviourist argue feedback as a means to self-regulation and self-directed learning and behavioural stimulus to the new situations.

One of the most vital features of feedback is its timing. Feedback can only serve the purpose; if it is offered or fetched during the time, it is needed or expected. The timing of feedback plays greater role for effective participation in the feedback process in intercultural collaborative learning. Wildflower [106] argues that the efficacy of feedback depends not only on the content, but also on the timing. Lou, Dedic and Rosenfield [100] refer to timing of feedback as the time interval the learners' response to a stimulation (i.e. question) and the feedback provided - connoting the main essence of immediate and delayed feedback, in which the immediate one implies positive effect [100]. Regarding online learning, immediate feedback can be considered as provision of feedback synchronously (interactively) while the time-delayed may emanate from asynchronous communication through Emails or discussion board with time delay.

Although asynchronous communication facilitates in-depth learning, there are also problems of delayed communication and feedback. Hall [107] supposed that there may be several reasons for delayed response, such as mailbox may remain unopened for several days due to either access problem, time constraints or lack of interest and motivation. Even after reading the feedback request, there will be also a delay in responding depending on the respondents view on the substance and the relevance of the request sent for feedback, language, time constraints, etc. Thus, the longer the response time, the more the communication will be hindered, the less the effectiveness of the feedback.

Furthermore, Wildfelder [106] states that asynchronous mode of communication can be ideal for distributed learning communities in which people live in different time zones and have varying levels and forms of hardware, software and Internet access capacity. With more time to consider and respond to ideas, online learning opportunities are equalized among people with different learning styles, work schedules, language and cultures, online competencies, and physical needs. As flexibility in response time supports reflective inquiry and critical thinking, learning is associated with the thoughtfulness and quality of ideas, rather than the quickness of response [107].

The time difference between the expectation of feedback and the response acquisition has greater impact on motivation and active participation of actors participating in the feedback flow. In this case, the time elapsed beginning from sending forth, processing and receiving back are important. It can be easily assumed that feedback process which requires longer time is more likely to fail, since the processing time length will discourage to participate in the feedback.

Time interval is the time duration between sending feedback and receiving back a response receiving feedback request and processing response and sending back to requester. Pertinent to our intercultural online learning where participants have quite diverse communication resources, ranging from dial-up modem to high speed cable, DSL, Satellite and Wireless (with a freedom of movement), the response time may depend on many factors, where the bottleneck at one point can stack all. To cite a sample, course participants with high speed connection and who can also access Internet any time are quickly frustrated with those who have slow connection, and/or who can only access at a particular time and location. Beside physical connectivity problems, skill and use experience, particularly quick response. Moreover language skill, especially writing is also vital factor.

With this in mind, we have highlighted important features of feedback, such as feedback types, sources and uses, and timing. Types of feedback can be classified in various ways.

Positive feedback seeks to increase the output or reinforces the loop or, as a negative feedback, it seeks to cancel the output or tends slowing down process [103]. Teacher/student feedback, on the other hand it gives hints on the feedback, say, from who to whom the feedback is given; while group/individual feedback classification concentrates on the features of participation. Sources and uses of feedback are dependent on the type of feedback.

Depending on the mode of education, such as face-to-face, conventional distance learning or online learning, collection, and use of feedback will provide immense opportunities to all stakeholders in the learning and teaching system. Feedback in classroom-based education is more or less informal and practice irregularly even without noticing that feedback is taking place. The dialogue and the interaction among participants in class-rooms are part of the feedback. Such feedback process has that comparative advantage, as it can be fully interactive. The time interval of the feedback sending-receiving, processing and responding may be responsible for the positive (reinforcing participation) or negative (delayed action) feedback. This aspect of feedback is also revealed in the feedback model, such as with a group-based eLearning, where feedback is vital. Feedback in group-based eLearning has the following advantages:

- Engage each other in more discussion, problem solving, and critical thinking, thereby enhances deep learning
- encourages socialization and sharing knowledge
- widen scope of thinking while exchanging knowledge globally

In as much as the online learning environment has made it more convenient through asynchronous and synchronous communication, feedback will be also quite sensitive and needs to be cautiously designed as well as integrated in the learning system. It is very sensitive and fragile since the cultural diversity as well as distance and time zone difference; it may easily pose misinterpretation of feedback and turns the outcome unconstructive.

Some of the barriers in online are:

- communication language, particularly in formal written communication
- time consuming due to negotiation and due to the inherent nature of group work where equal pace from all group-mates will not be expected
- time zone difference and time constraint due to the life-long learning nature
- lack of well designed curricula and experience in moderation.

2.5.3 Message Sequence Charts for Feedback

From the technical point of view of the communication, interaction and feedback flow, this thesis takes advantages of the well established Message Sequence Chart (MSC), graphical and textual language for the description and specification of the interactions between system components [101]. Using MSC, it is quite admissible to specify scenarios that describe how different actors (e.g., system components, people, or organizations) interact, which is often discussed and applied in various behavioural models and software requirements studies and analysis, like, Event-driven Process Chains (EPCs), UML activity diagrams, BPMN models, Petri nets, etc.

On the other hand, the MSC is used in communication behaviour of real-time systems, by describing the pattern of interaction, i.e. as scenario or collection of scenarios. Moreover, the MSC is a modelling technique that uses a graphical and textual language for the description and specification of the interactions between system components. MSC was initially standardized by ITU (International Telecommunication Union, earlier CCITT) and usually applied to applications of the telecommunication domain [101]. However, it can be applied on every stage of system development, test case development, describing certain portion of system behaviour or a scenario of communication and message flow (asynchronously or synchronously) between actors [108]. MSC is also used in the technical and software development field particularly in requirement specification, simulation and validation, documentation and other tasks.

Having looked into the requirements and objective of modelling feedback we envisage, we decide to graphically depict the flow, which shares some basic principles of MSC, such as the asynchronous message transfer (with time interval). The principles and specifications widely used in the MSC can be used in our scenarios-based feedback model, though there can be some adjustments, like the usual use of MSC in telecommunication area for technical system, whereas we use, the whole principle with slight modification, in a socio-technical system.

From the technical point of view, the feedback model highlights the process of interaction among actors and feedback flow. Actors' interaction and feedback flow can be modelled in various ways, using a sequence model. Sequence model can be designed using the Message Sequence Chart (MSC). MSC is widely used (some denote it as well known) language for specifying scenarios that describe how different actors (e.g, system components, people, or organizations) interact; often used as a starting point

for software analysts to discuss the behaviour of a system with different stakeholders. Hence, our feedback model based will be the MSC approach.

For the practical aspects, we have applied the Message Sequence Chart (MSC), particularly to design a feedback model. MSC is a modelling technique which is an integral part of the System Development Language (SDL). Details of the choice of the modelling techniques and review of the modelling language and tools are discussed in this chapter.

2.6 ePortfolio use and eFacilitation

eFacilitator is online facilitator, that is interchangeably used as online moderator, or tutor/mentor. When we discuss eLearning as a collaborative action, we indeed mean actions/reactions of all participants including the online facilitators (or eFacilitators). The role that will be played by an eFacilitator is much more crucial, particularly in the case of eLearning in developing countries. Few remarks will follow, while this theme will be deeply discussed later in chapter five and six.

Literarily eFacilitator is defined, in Merriam Webster Online Dictionary¹³ as “one that facilitates; especially: one that helps to bring about an outcome (as learning, productivity, or communication) by providing indirect or unobtrusive assistance, guidance, or supervision”. On the other hand, the Free online Dictionary¹⁴ defines it as “someone who makes progress easier, or a person who contributes to the fulfilment of a need or furtherance of an effort or purpose” while, the Online reference¹⁵ defines it as a person responsible for leading or coordinating the work of a group, as one who leads a group discussion.

eFacilitation or online facilitation is a new phenomenon that arises with online learning, though traditional facilitation or tutoring has long been exercised. In this section we focus on mere online facilitation and the existing model or practice in eLearning. Towards this end, we will look into widely referred model built by y Salmon [46] which has been extensively-based on her long years of experience in open and distance education, discussed in her book ‘eModerating’.

¹³<http://www.merriam-webster.com/>

¹⁴<http://www.thefreedictionary.com>

¹⁵<http://dictionary.reference.com>

As previously discussed, the 5 phases of eModeration model explained the individual access and the ability of participants to use computer-mediated communication; individuals' participation establishing their online identities and then finding others with whom to interact and to give information relevant to the course to each other; the course-related group discussions and the interaction that becomes more collaborative; and finally, the participants action to benefit more from the system to help them achieve personal goals, explore to integrate computer-mediated communication into other forms of learning and reflect on the learning processes.

All in all chapter two has tried to highlight the various theoretical and analytical foundations for eLearning, ePortfolio use in eLearning, ePortfolio use for reflective feedback and to enhance eFacilitation. The Concepts are also elaborated to suite into the context and the realities of eLearning in DCs. To this end, effort is also made to identify and define critical success factors in the context of eLearning in DCs. These critical success factors are also associated to the actors in eLearning and the overall theoretical research framework. Thus, it was concluded that the conceptualisation and contextualisation of the eLearning environment and eLearning process in DCs is recommended to be studied from the point of view network of actors.

Moreover, critical success factors within the network of actors have been identified and defined. Subsequently the role (or impact) and relationship of each critical success factor to individual actors were thoroughly and continuously assessed and evaluated. This thesis has laid a cornerstone by selecting and defining and evaluating the role of four basic critical success factors such as access to and use of technological infrastructure requires; the self-efficacy of Internet use for eLearning; group-based online learning and eFacilitation and lastly use of ePortfolio-for reflective feedback, in the context of promoting sustainable eLearning in DCs. The overall theoretical framework can be summarized graphically as depicted:

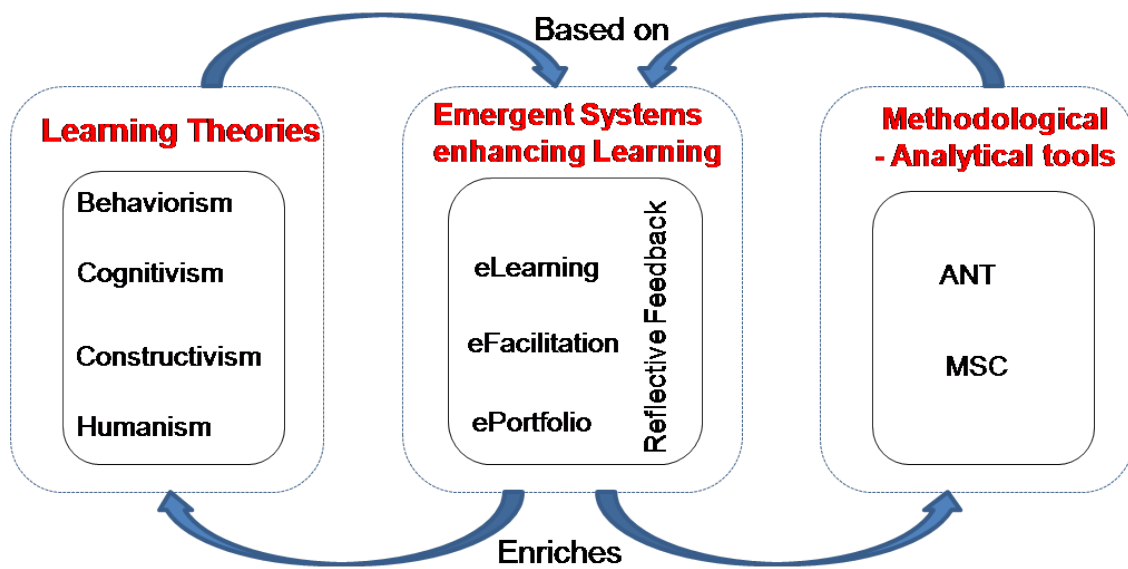


Figure 2.4: Summary of Overview of Theoretical Framework

Chapter 3

Methodological Approaches and Research Design

*Research as a 'method' stays the same, but the frontiers of knowledge and technique
are always on the move into new territory*
John Ziman¹

3.1 Introduction

This chapter discusses the research methodological approach and the research design of the thesis. A research method and approach is, according to Myers [109] "a strategy of inquiry which moves from the underlying philosophical assumptions to research design and data collection", to which choice of a certain research method influences the way in which the researcher collects data. The research methodology used in this research is a qualitative approach, which is widely used in several information systems researches. This is mainly because, the thesis primarily focuses on revealing CSF and in-depth understanding of eLearning in the context of DCs. Besides, from the point of view of the actors perspectives, this methodology suited to case studies and the overall research approach.

By underpinning the research methodology, effort is made to underline the systematic

¹In his book Prometheus Bound: Science in a dynamic study state, 1994, P. 19.

problem solving processes and methods to use them as instruments while realising the case studies (discussed in chapter 4 and chapter 5).

The chapter is structured in three broader sections. The first section presents the features of qualitative research methodological approaches and categories in general and the relevance to this research in particular. The second section discusses the research design, while the third section highlights the data collection methods and sources.

3.2 Qualitative Research Methodology

A qualitative research methodological approach that focuses on studying things in their natural settings [110], where the researcher builds a complex, holistic picture [111]. This type of methodological approach is undertaken based primarily on constructivist perspectives [112], i.e. concerned primarily with the process, rather than the outcomes or products, to which, researchers' venture to reflect or interpret the settings of natural phenomenon [110] for the knowledge construction.

Basic characteristics of qualitative research are the exploratory and descriptive focus and the emergent design [111]. In qualitative research methodology a variety of empirical materials are undertaken through case study, personal experience, introspective, observational, interactional, visual texts etc. that describe routine and problematic moments [110]. Therefore, problems are studied in their natural setting based on a case study as well as accompanied by on-going inductive analysis [111].

There are various types of qualitative research methodologies that are used singly or in combination in various fields of studies. Major categories used in this thesis are grounded theory methods, situation analysis, case study and action research. Hereunder follows a brief summary of each of these selected categories of qualitative research methodologies in order to give insight into basic features as well as to substantiate the relevance of choice of the research methodologies for this thesis.

1. Grounded Theory

Grounded theory is broadly defined as 'an inductive, theory discovery methodology that allows the researcher to develop a theoretical explanation of the general

features of a topic while simultaneously grounding the account in empirical observations or information' [113]. On the other hand, grounded theory approach is defined by [114] as "a qualitative research method that uses a systematic set of procedures to develop an inductively derived grounded theory about a phenomenon".

Grounded theory has become a very popular and epistemologically sound approach to qualitative analysis, as 'constant comparative method' [115], inductive enquiry and analysis, as well as a methodology that stresses on the continuous interplay between information collection and analysis that seeks to develop theory that is grounded in information systematically gathered and analyzed [116]. Essential features of grounded theory, as [117] cited, and relevant to our thesis are:

- (a) It is explicitly emergent
- (b) It does not test a hypothesis
- (c) It sets out to find what theory accounts for the research situation as it is. In this respect it is like action research: the aim is to understand the research situation

In general, grounded theory approaches are becoming increasingly common in the information technology and systems research literature, mainly because the method is extremely useful in developing context-base, process-oriented descriptions and explanations of the phenomena [116] and interactions. Apparently, grounded theory found applicable from the perspective of contextualization of Critical success factors and understanding the role of actors and actors' network in promoting eLearning in DCs.

2. Situational Analysis

With the elapse of time and swift development in the research environment and direction, research methodologies and approaches are also compelled to include new phenomena or shift to other directions. One example in this case is the situational analysis research methodology that moves the grounded theory towards post-modernism as deeply studied by [118].

Situational analysis has a different guiding metaphor from the traditional grounded theory, in which situational analysis research methodology [118]. has

replaced Strauss's situation-centred "social worlds (or arenas) negotiations" with a framework categorized by [118] as:

- (a) Situational maps: That lay out the major human, non-human, discursive, and other elements in the research situation of inquiry and provoke analysis of relations among them; and
- (b) Social arenas maps: That lay out the collective actors, key non-human elements, and the arena(s) of commitment and discourse within which they are engaged in ongoing negotiations-meso-level interpretations of the situation.

This thesis relays on the situation maps and social arenas maps that can best suite the socio-technical analysis, mainly specified as human and non-human actors. The situational analysis can be used in a wide array of research projects drawing on interview, ethnographic, historical, visual, and/or other discursive materials, including multisite research [118]. Moreover, situational analysis allows researchers to draw together studies of discourse and agency, action and structure, image, text and context, history and the present moment-to analyze complex situations of inquiry broadly conceived [118].

3. Case study

Case study research is the most commonly used and broadly accepted qualitative research methodology. As defined by Yin [119], a case study is an empirical inquiry which investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident. Briggs and Coleman [120] also add that the concept of case study research methodology is a qualitative methodology that assists to conduct an empirical inquire within a localised boundary of space and time (i.e. singularity) in its natural context of educational activities, programs, or institutions.

Basic features of case study, as a qualitative research methodological approach are its capabilities to closely examine specific phenomena such as a program, an event, a process, individuals, institutions or social groups [121]. These features are:

- Particularistic - focuses on a particular context

- Naturalistic - is about real situations and information collection occurs in real environment.
- Descriptive information-sources of case study information include participants and non-participants observations, interviews, historical and narrative sources, writing such as journals and diaries.
- Inductive - case studies rely on inductive reasoning and generalizing concepts or hypotheses that emerge from the examination of collected data [122].

In other words, case study qualitative research methodology can be classified into different phases [120], such as:

- indentifying the research purpose and formulating research questions
- collecting and storing information
- generating and testing analytical statements
- interpreting or explaining the analytical statements
- deciding on the outcome and writing the case study report (publishing)

These features of the case study research methodology are particularly well-suited to researches in information systems and technology, as the research in this sector is shifting [123] from pure technical issues to organisational and application in humanity sciences. The core of the methodological approach of this thesis is also based on mainly case study principles.

4. Action research

Action research is another widely used qualitative research methodology [120], quoting Pamela Lomax [124] highlight the concept of action research by reformulating the definition initially given by Carr and Kemmis [125] as "a self-reflective, self-critical and critical enquiry undertaken by professionals to improve the rationality and justice of their own practices, their understanding of these practices and the wider contexts of practice.

The fundamental contention of action research is that a complex social process can be studied best by introducing changes into that process and observing the effects of these changes. While conducting action research, researchers are not only observing phenomena, but they are also intervening and participating in

the subject under study [126]. Therefore, researchers are actively learning from the course of each action and monitors the process.

Some of the main features that differentiate action research from other qualitative methods [117], are:

- Cyclic - similar steps tend to recur, in a similar sequence
- Participative - the clients and informants are involved as partners, or at least active participants, in the research process
- Qualitative - it deals more often with language (words) than with numbers
- Reflective - critical reflection upon the process and outcomes are important parts of each case study

Coupled to this, action research is an ongoing process of continuing to reflect on practice, identify problems, and formulate new research questions and action plans to remedy the problems. So it never ends, at least as long as the practitioner feels there are still ways to improve practice [127]. The case studies of action research terminates, when the investigation reach saturation, i.e. when there seems no need for new investigations. This means the evaluating and learning phases produce little change to any of the categories, especially the core category [117].

Another feature of action research is, as Lomax in [120] cited that it adds a self-conscious discipline to reflective professional practice, which is designated as inward looking dimension (or inward reflection) putting emphasis on the researcher as a learner, committed to personal development through improving the understating of her/his own practices. Besides, there is also a reflective practice viewed as outward-looking dimension [120] where the emphasis lays on the researcher as a collaborator, actively seeking the validation of her/his practice and knowledge (reflexivity).

Due to appropriateness of these stated features, this study is conducted based on action research. Therefore, a serious of iterative case studies, in line with an action research, have been realised to which the researcher has various roles, such as a facilitator, a project coordinator and finally as an evaluator of the findings. Moreover, action research is also found convenient to analyse the critical success factors (discussed in chapter two) based on the actor-network theory.

3.3 Research Design

The research methodological approaches, as it has been discussed in the preceding section, are designed based on qualitative research methodologies, to assess and evaluate problems continuously and iteratively. This is mainly due to the steadily changing eLearning and the network of actors in general and the critical success factors in eLearning in particular needed for case study based action research. In addition to that, data collection, processing and analysis have been also based on grounded theory, which is one of the categories of the qualitative research methods. With this, four iterative case studies have realised been for nearly three years.

This in mind, the research design itself has undergone a series of iterative processes. The initial was defining the general framework by conducting a preliminary study. Subsequently, the iterative approach to realise the case studies was designed. This has included the data collection, processing and analysing methods. The discussion in this part is based on these issues.

3.3.1 Framework as Iterative Approach

The preliminary study commences on assessing if eLearning in DCs was different from that of the eLearning in industrialised countries. This led to undertake a review of literature on basic features, practices, challenges and success stories, etc. of eLearning in both DCs and industrialised countries. The objective was to set a study framework for the cases, i.e. refining the theoretical framework discussed in chapter 2.

As a result, a three dimensional graphical model, i.e. a conceptual model was designed to highlight the relationship and role among actors in eLearning . The network is created by these actors, where each actor strives to purposefully fulfil its specific interests. Therefore, the subsequent models designed, implemented and evaluated in all of the cycles of the case studies are based on this conceptual model.

Four case studies are designed and realised iteratively based on action research. Each case study deals with specific research questions, whereas, each case study has four phases² of actions (tasks) to be sequentially carried out to complete the case study.

²Theses are also case studies. It is simple called phases to spare confusion.

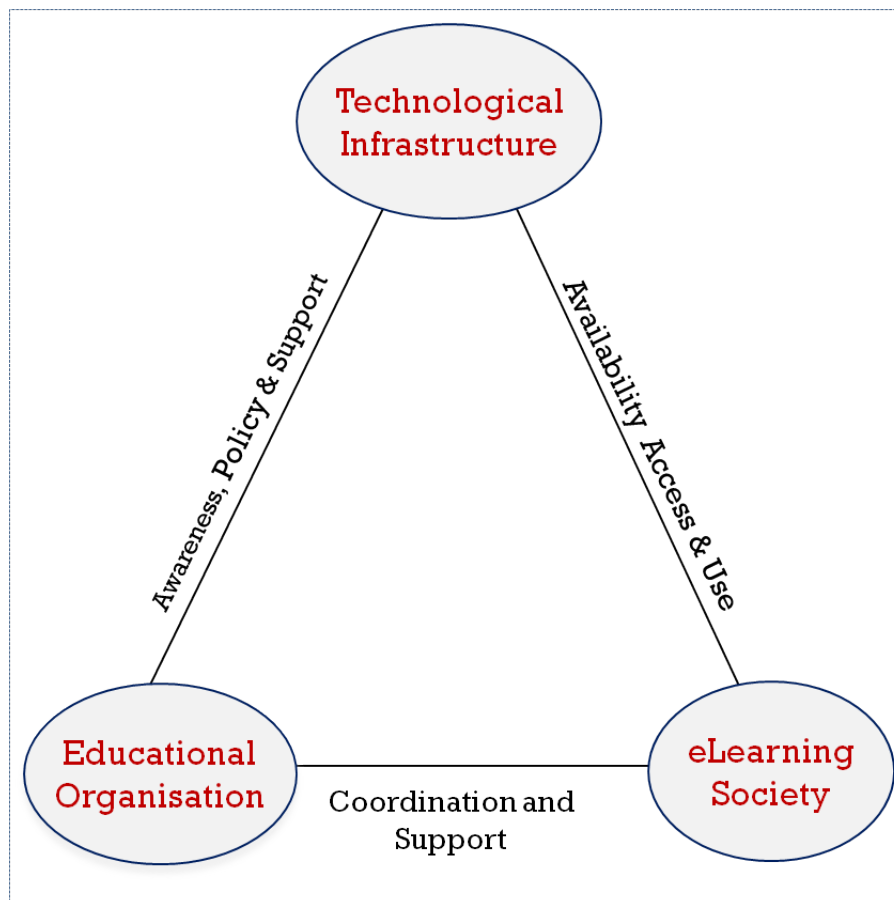


Figure 3.1: Model for eLearning as Network of Actors

The thesis is an action research supported by a case study to which the overall approach is designed based on the widely used 'The Kolb Learning Cycle' or 'The Experiential Learning Cycle' [41]. Each learning case study comprises to four different stages of learning from experience and can be entered at any point but all stages must be followed in sequence for successful learning to take place. Besides, as experiences gained on previous case studies were the basis for the subsequent action; it is not merely cyclic but the knowledge gained is also higher level.

Towards this end, the four phases of each case study were iteratively conducted. This iterative approach applied later in the four iterative cyclic case studies, are summed up as depicted in the Figure 3.2.

Each case study consists of four iteratively realised phases, i.e. problem definition, modelling, implementation (including data collection and analysis), reflecting on find-

ings, which in sum constitutes a learning cycle³. Learned experiences gained on previous case studies are the basis for the subsequent action. This constitutes the iterative and continuous investigation undertaken.

The overall iterative approach to realise case studies in four phases of problem analysing methods is depicted in the Figure 3.2.

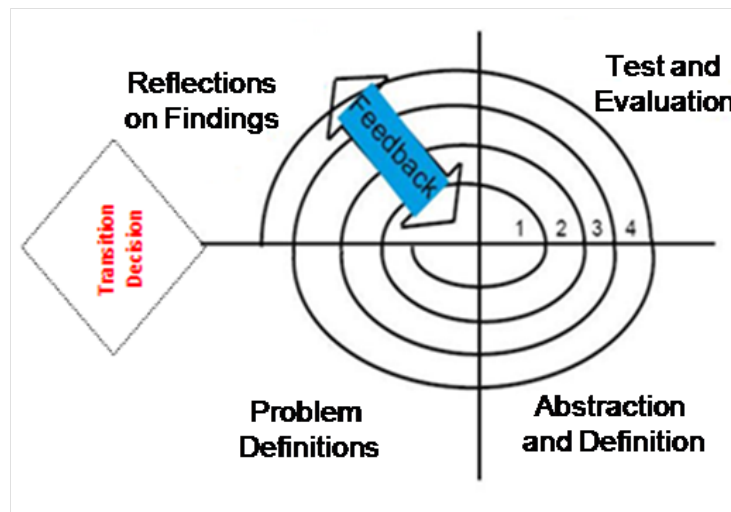


Figure 3.2: Research Design: Iterative Approach

The Figure 3.2 shows four phases consecutively executed for each case study. The initial phase begins with problem definition (i.e. formulating a research question) followed by abstraction of the problem statement and thereby constructing a model to be implemented during the third phase. To complete the cycle, the fourth phase deals with analysing and reflecting on findings. Finally, there is a transition gap, which in this thesis is designated as a 'transition decision' meaning a decision to stop based on the results, whether the cycle of the case study shall continue or to exit. In this case, thus, if findings have been found satisfactory and there is no need for further investigation, then the iterative action will cease and finally report will be documented. Otherwise the iterative action will continue until there is a decision to stop.

³Every experimental cycle is a learning cycle [41]

3.3.2 Problem Definition

Problem definition in this context is meant elaboration of the specific problem domain which is the underlying foundation to carry out this part of the case study. At the initial phase the problem definition phase tries to elaborate the research problem statement in general and the research questions. Each case study realised is based on specific research questions, i.e. the first cycle of the case study had been initiated and realised to assess and evaluate the initial research question. Similarly the second, the third and the fourth cycles of the case studies had been realised in line with the subsequent research question raised. This connotes how the research is designed and problems are systematically and iteratively as well as inductively formulated and elaborated.

The problem definitions and elaborations are the initial phase of the problem solving process. In line with this, for the sake of simplicity, problems of each case study have been elaborated in this section.

3.3.2.1 Case Study I

The objectives of this case study are to assess how eLearners access and use the eLearning infrastructure, and on the other hand to capture feedback from eLearners about their eLearning environment and eLearning process in the context of Ethiopian higher learning.

Alongside with this, there arose some curiosities, such as to what extent the existing technological infrastructure access and use inhibit eLearning; as well as why these issues are big worries, while there are rapid development in technological infrastructure supply. In short, the first question dealt with the two of the critical success factors, i.e. TA and TU. This is mainly because of the following reasons:

- Access to eLearning Technological Infrastructure (TA): Issues related with Internet connectivity and access is complex and dependent on many factors, namely the available bandwidth, the cost and affordability, dependability i.e., is the connectivity available every time or are there down-times due to congestion and power stoppage, etc. TA is also dependent on physical resources and the connectivity type, for instance, place of access, such as home-based, workplace or Internet Café.

- **Technology Use (TU):** Despite the fact that effective use of the eLearning technological infrastructure is dependent on the availability, affordability, usability, etc. of the system itself effective use is also dependent on the level of the skill eLearners possess, and also on the ownership (such as single or shared) of accessible resources or relationship between the available resources and the users' skill. Ownership and where and when to access determine the frequency and freedom of access, i.e. any time and anywhere. This in turn affects the skill formation as well as confidence that could be built through frequent practices.

This showed that, TA and TU problems cannot be singled out as mere technological infrastructure leaving aside the role and impact of educational organisation. Access and use of technological infrastructure for eLearning are seen from the point of view of complex socio-technical network of actors. All in all, the problem definition part of the first case study attempted to scrutinize two of the critical success factors, i.e. TA and TU from the point of view critical success factors for the eLearning environment and as a socio-technical complex system driven by the combined actions and interactions of actors within a defined network.

3.3.2.2 Case Study II

The problem definition and elaboration part of the second cycle of the case studies is based on the second research question, which is also based on the findings from the first case study (discussed in chapter 4) showed that there were firstly, insufficient information on the access to the use of the eLearning environment; and secondly the information we got from the log files and Email communication were not necessarily reflecting the eLearners problems of accessing and using the LMS. Therefore, the decision made was to continue with the inquiry of assessing the self-efficacy to Internet use for eLearning.

Thus, assessing self-efficacy to Internet use has been evolved out of the problems to determine access for eLearning technological infrastructure and use (i.e. TA and TU) from previous case study. Yet, vital is the self-efficacy of eLearners to Internet use which is based on the belief and confidence they have to effectively use the resource, the self-assessment and reflection on one own capabilities and the skill to achieve a desired goal, i.e. eLearning. The problem statement of the second case study was

therefore formulated as "how do we capture information on eLearners' ISE along side reassuring the TA and TU began in the first case study?"

This will not only reassess to reveal the eLearning environment, i.e. the Internet connectivity, access and eLearners capacity to effectively use the online learning management system, but it may also help to link this concept to requirements study.

The self-efficacy to Internet and computer use is not only reflecting behaviour of eLearners we envisaged assessing, but it also indicates the background of eLearners technology use experience and skill. The second case study was focused on eLearners' perceptions, judgement or confidence to use Internet and diverse application tools, including LMS, to achieve an academic qualification.

Highlighting and defining these problem fields was to better conceive and assess the TA, TU and eLearners' ISE in the context of Ethiopian higher learning. With this the next step will be refining these complex issues and build a conceptual model.

3.3.2.3 Case Study III

The problems defined and elaborated in the third cycle of the case study emanated from the two previously realised case studies in the context of the Ethiopian higher education. During these case studies what remained unfulfilled was the online communication and interaction among eLearners themselves and with the eFacilitator. Therefore, it was decided to initiate a third cycle of the case study with international participants and focussing on group-based online learning (without face-to-face sessions).

The problem domain in the third case study was feedback on the group-based online learning in an environment where participants have different access to eLearning infrastructure and varying skill to Internet use. Besides, access and use of technological infrastructure to eLearning and self-efficacy to Internet use are also reassessed to reassure the possibilities of capturing feedback from the international cross-cultural online learning groups of participants. The problems raised were which are summed up as the third research question in chapter 1. The background and arguments for the third case study are:

- One of the main promises of eLearning is access to education "for everyone, anytime, any place" connoting global participants learning together, irrespective

of the temporal variation (time zone) and spatial location (where they reside), but what we have experienced during the two case studies were that eLearners residing in one location who preferred to frequently meet avoiding using the online environment

- Not only online learning in group, but also the social network, languages, cultural, etc. factors are problems areas to be disclosed, if eLearning should be perceived as a paradigm shift towards providing opportunities for global and intercultural online learning
- The motivation was the effort started to continue by way of including participants from different countries (across different cultures) with different resources and skill background

Therefore, the researcher tried to address the following questions during the third cycle of case studies:

- How is the access to and use of eLearning technological infrastructure, the Internet self-efficacy and the group-based online learning environment affect the information flow, i.e. feedback from learning process?
- How are the communication and interaction mechanisms among eLearners with different cultures; differing academic background as well as those possessing greatly varying connectivity to Internet and technology use culture?
- How is group-based eFacilitation (online tutoring) for larger number of eLearners?

3.3.2.4 Case Study IV

The problems with capturing feedback from the eLearning environment and eLearning process had been sufficiently discussed, based on iterative assessment of various critical success factors associating with, explicitly and implicitly, the actors and network of actors in eLearning. Findings and learned experiences indicated that, in one way or another, feedback could be captured.

However, feedbacks collected from temporarily used and unstructured sources are not only difficult to analyse, but also difficult to process, store and publish for further

use. Moreover, it was also difficult to personalise the information collected, i.e. to associate with individual eLearners.

Therefore, problem domain and the discussion on ePortfolio use were, to:

- Collect persistent repository of feedback in more structured manner that could serve for longer and wider use
- Collect and process reflective feedbacks that were formal and justifiable different from information gathered from informal source such as Email, online chat or discussion board
- Collect, process and selectively publish reflective feedback (from a larger repository of information collected)
- Provide an eLearner owned and managed repository of feedback, different from any online formulae and templates to which eLearners may be reserved to use

Moreover, the fourth research questions realised during the fourth cycle of the case studies was how to capture reflective feedback using an ePortfolio. Besides, assuming that it was possible to capture the planned (wished) reflective feedback, could we then improve communication and interaction among eLearners and make group-based online learning effective? This is mainly because of problems in the previous case studies were problems of capturing feedback. Due to lack of reflective feedback about the eLearning environment of eLearners and lack of knowledge on the eLearning process as well as problems and/or successes of eLearners are problems to group-based eLearning and problems of undertaking effective eFacilitation.

Therefore, to use an ePortfolio as repository of reflective feedback, needs to integrate the component 'ePortfolio' into the conceptual model, i.e. the three dimensional actors-network and packages of components of critical success factors, that was iteratively used and continuously refined.

3.3.3 Problem Abstraction and Modelling

Problem abstraction and modelling are often discussed in various fields of studies as investigation methods for searching the space of logically equivalent problem reformulations [128] in view of refining the problem space. There are plenty of problem

abstractions or problem solving schema in information systems that may be based on using either mathematical or graphical modelling systems to deliberately simplify and pick out the most salient characteristics [129]. Problem abstraction and modelling is considered as an elucidation and specification of the major part of the problem through models based on graphical representation.

In this context problem abstraction in all of the four cycles of the case studies are discussed using graphical representation. The graphical representation or simply the models in each of the four of the case study are highlighted as part of the effort to define the problems under study in relation with the network of actors. Herewith follows a short highlight on the problem abstraction of each case study.

3.3.3.1 Case Study I

The abstraction and modelling section refined the relationship between eLearners access to and use of eLearning technological infrastructure and the main actors, namely technological infrastructure, educational organisation and eLearning society. The purpose is to build a model, which consists of major aspects of the bigger problem that this model is deduced from. In designing a model, as [130] stated, one is responding to situations in the world by creating novel artefacts to facilitate our activities and enrich our experience.

Therefore, the model was designed for the initial cycle of the case studies highlight the relationship among the technological infrastructure access and use by eLearning society while the educational organisation provides all services and coordinates the effective use to attain the pedagogical goal set. This makes the relationship among these three actors asymmetrical with mutual coexistence, while each actor tries to maximize its utility. With this, the model is depicted as a triangular three-dimensional graphical representation where the TA and TU (packed together as critical success factors) are connected with all actors, as depicted in Figure 3.3.

The graphical representation of this model shows actors as nodes, while the edge connecting one node to the other reveals the relationship between the two nodes. The relationship is a non-directional relation, which is non-specific about the origin or destination of the flow on the link. On the other hand, the relationship defines the role and functions of each actor within that network.

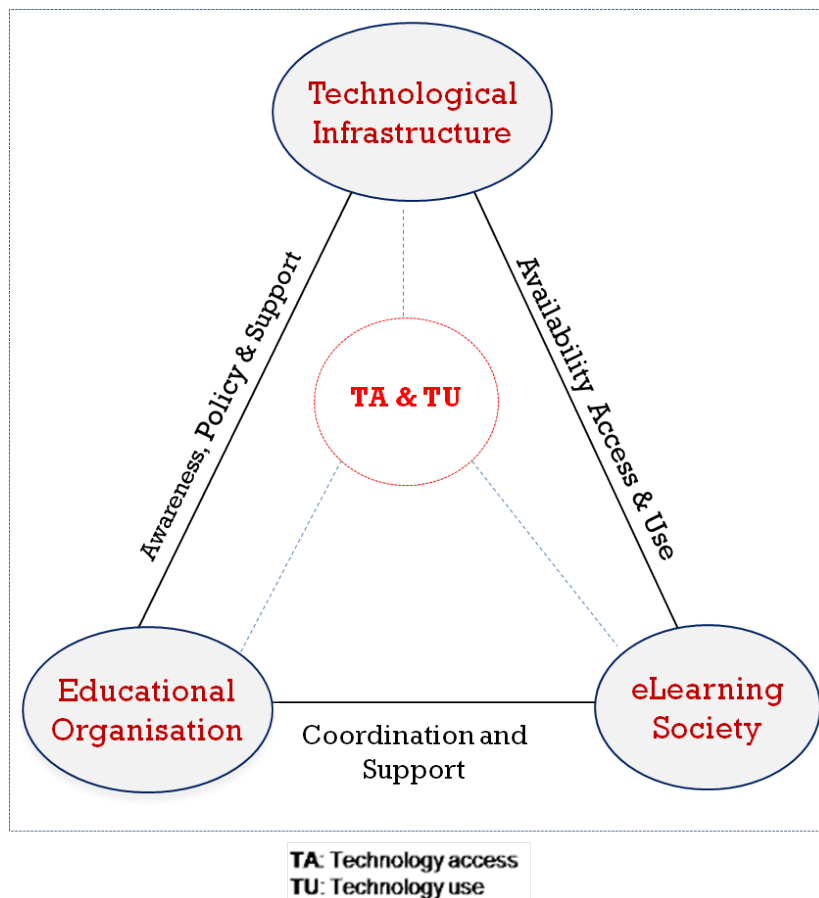


Figure 3.3: Model for Case Study I

3.3.3.2 Case Study II

The self-efficacy to Internet use is integrated in the existing conceptual framework (model) to enable assessing the attitude as well as to perceive knowledge revealed by eLearners. The graphical model used in the first case study is extended with ISE. Therefore the graphical representation TU, TA & ISE drawn in the middle of the triangular diagram are also connected to all three actors in eLearning services development.

From the point of view of eLearners and technological infrastructure, the model depicted refers to the access (availability) and use (affordable) of technological infrastructure, while the role of the organisational comprises to support services (mainly eFacilitation and provision of suitable learning content). All in all, the model used

during the second case study can be summarised as it is depicted below in Figure 3.4.

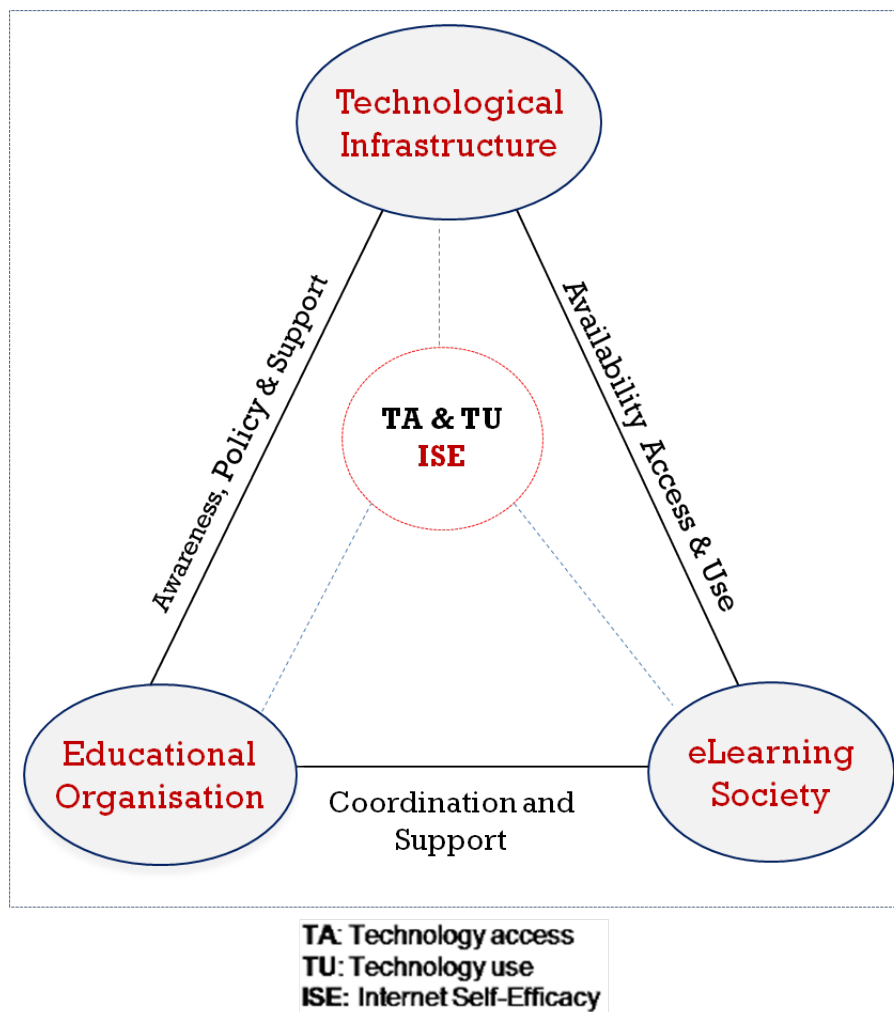


Figure 3.4: Model for Case Study II

Generally speaking, the graphical model highlights the ISE in line with TA and TU associating with the relationship among network of major actors defined. Thus, self-efficacy component strengthens the TA and TU in one hand, and on the other hand assists to overview the self-regulated eLearning system based on the available technological infrastructure and the support services provided by educational organisation.

Finally, the implementation as well as the information collection and analysis will follow, based on the designed model and mentioned focal issues, i.e. investigating the ISE of eLearners in relation with TA and TU in the context of eLearning for Ethiopian

higher education.

3.3.3.3 Case Study III

As summarised in the preceding section, the problems were how to increase communication and interaction so that the planned group-based eLearning could be effectively realised. In the previous case studies, it has also been modelled that access to and use of the eLearning infrastructure as well as the Internet self-efficacy could be assessed in relation with the actors and network of actors. Similarly, for the third case study, effort is also made to integrate the group-based component into the existing framework.

Towards this end, the model in Figure 3.5 was extended from the Figure 3.4 so that it can contain the component G-eL, i.e. group-based eLearning. Similarly, actors in the network will be focussing on group interaction and group online learning.

3.3.3.4 Case Study IV

The problem abstraction phase of the fourth cycle of the case studies dealt with designing a model to capture reflective feedback using an ePortfolio. Thus, the problem abstraction of the stated problem, artefacts of the ePortfolio was identified. The artefacts were deduced components of the critical success factors as well as elements of the actors in the eLearning network. Thus, it is tried to embed in the whole conceptual framework of ePortfolio, as one component, into the network of actors. With this the model is extended to embed the component ePortfolio within the network of actors and place the ePortfolio on the top of the previously implemented model to take advantage of the experiences gained.

Generally speaking, the ePortfolio in this model is conceptually integrated with the three impacting actors, in such a way that the prototype ePortfolio shall contain features of three impacting actors. Accordingly, the extension of the previous model with ePortfolio on the top is related to actors' technology, organisation and eLearners. Basic features like, profile of eLearners and their reflective feedback, eFacilitating and other support services from the educational organisation, information on technology access and use, etc. were features this model consists of.

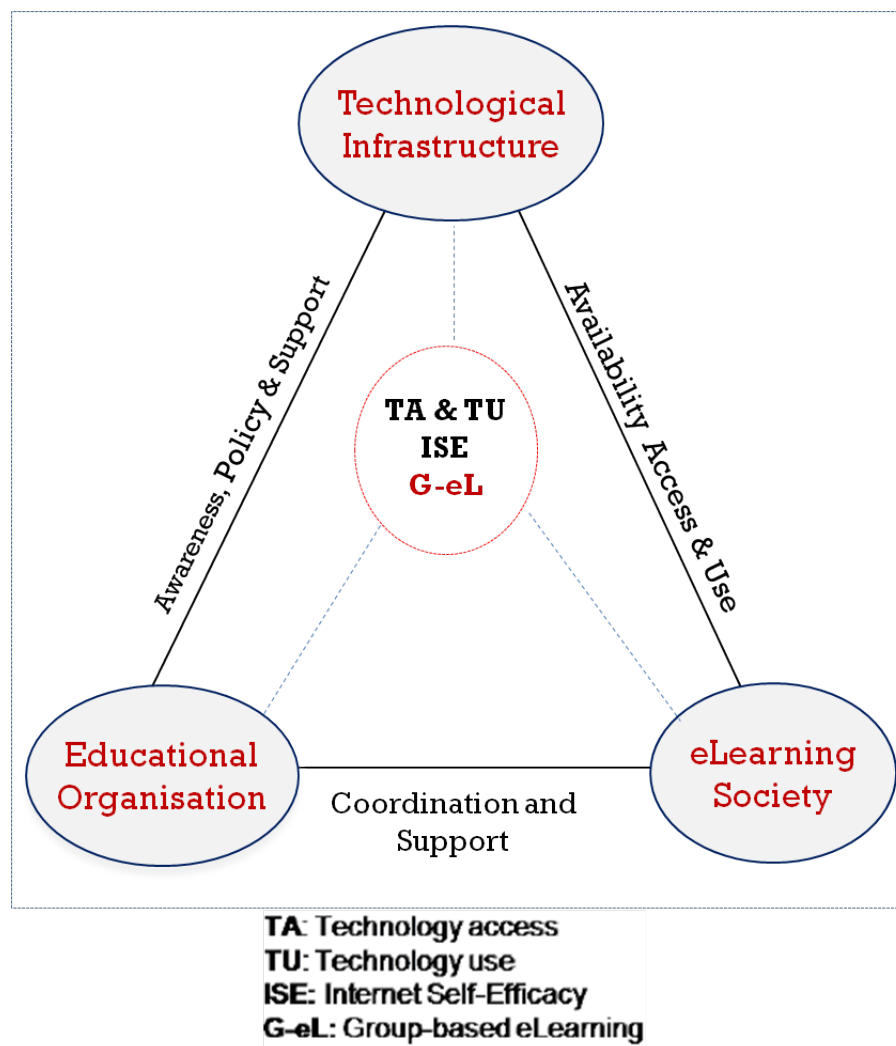


Figure 3.5: Model for Case Study III

3.3.4 Implementation and Evaluation

The third phase of the problem solving methodology designed in this research is the implementation of the problems defined and elaborated and models designed. The implementation commenced with organisation of the several tasks.

The organisation of the first case study began with a field survey in Ethiopia and later in Germany. The main objectives were to closely study the opportunities and challenges at the local environment in Ethiopia, and to assess the experiences of the German universities. Moreover, the field study had been a suitable ground to build

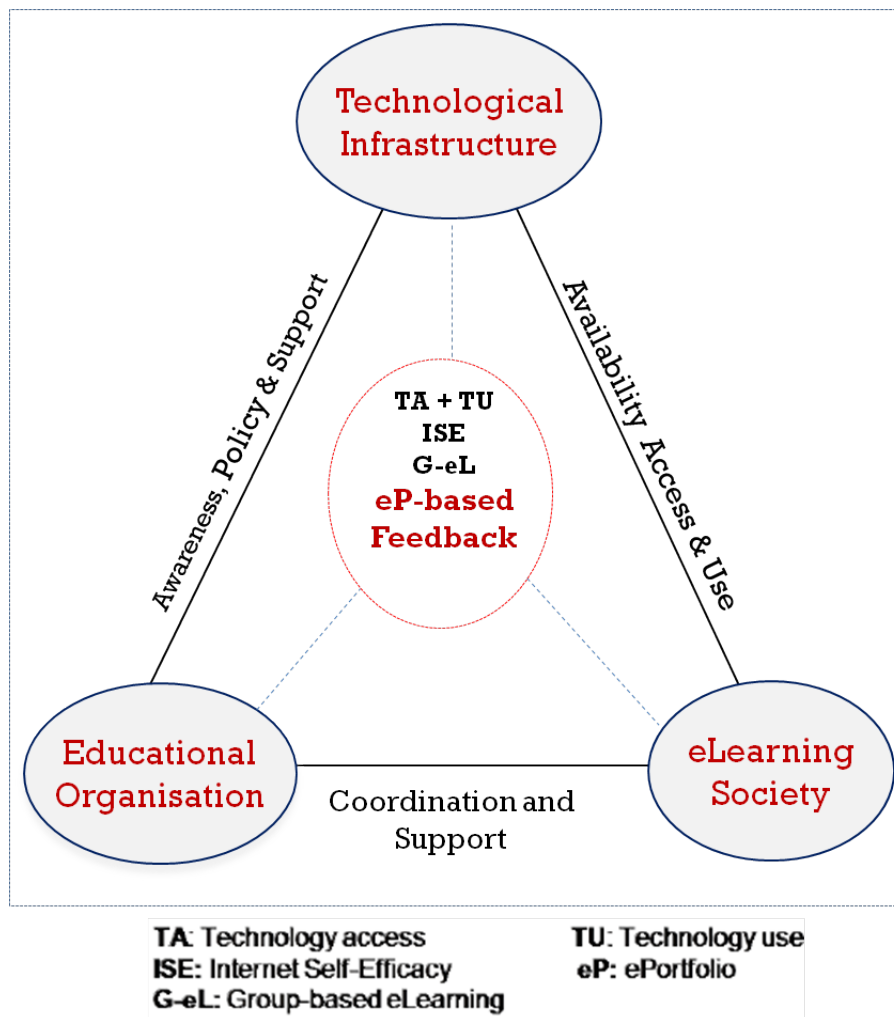


Figure 3.6: Model for Case Study IV

institutional and social networks which at a later stage- helped in seeking partners to jointly realise the case study.

With this, the researcher visited four public universities and two private colleges in different parts of Ethiopia. Short paper on the 'promises and challenges of eLearning in Ethiopian higher education' was presented and discussions with experts and management officials had been conducted. A meeting with the State Minister of the Ministry of Education of Ethiopia had been arranged to discuss the country's policy in eLearning particularly the accreditation. On the other hand, similar details of study and survey had been conducted in Germany, by visiting two distance and

eLearning higher learning institutions, namely the Distance University of Hagen and the Oncampus of the Luebeck University of Applied Sciences (LUAS). Parallel with that there has been also a broad study on transferring experiences gained in Germany to start an eLearning case study in Ethiopian higher education.

Finally, during the implementation phase, data required for the evaluation are continuously collected, classified and analysed. Details of the implementation and analysis will be discussed in chapter 4 (case studies one to three) and chapter 5 (case study).

3.3.5 Findings and Reflection

The last phase of the case studies concludes with analysis of the findings from performed actions as well as reflecting on the overall process of actions i.e. problem definition, abstraction and modelling and implementation; and the final outcome. The analysis is done based on the information collected and processed.

There are several ways of analysing findings, of which this thesis considers descriptive and interpretative analysis customarily applied in qualitative research methodological approach. The descriptive analysis deals with documenting, summarizing and reporting information (quantitative and/or qualitative) collected and finally analysing the outcome in line with the other qualitative information. On the other hand, interpretive methods of research in qualitative approach aims at constructing an understanding of the context ([131]; referring to the works of Walsham [132]) of the domain problem based on the level of knowledge (implicitly the information acquired) acquired on the actions performed. Besides, the interpretive analysis portrays the meanings, reasons and consequences of the overall process and outcome based on the knowledge gained from the practices as well as the theoretical background emanated from different previous experiences and analysis, i.e. literature.

The last phase is reflection on the overall process and outcome. One of the most remarkable studies in understanding the theory and practice of learning is Donald Schön's [133] great contribution i.e. 'The notions of reflection-in-action, and reflection-on-action'. Beside Schon, [134] provides a useful overview of reflection and a framework for the consideration of reflection in learning and professional development. In this connection [134] contributed a notion of 'map of learning and the representation of learning and the role of reflection' and her practical approaches to using reflection

to enhance learning [134]. Accordingly, the reflection part draws conclusion based on the learning experiences throughout the phases the case study underwent.

3.4 Data Collection Process and Analysis

In this part, data collection and processing methods and classification of data sources as well as analysis are discussed. Later, while discussing the case study, data collection, processing and analysis will be revisited in detail and specific to each case under study.

3.4.1 Data Sources

Source of data for the case studies are mainly collected from the system generated statistical information like log files and texts through various ways. The objective of data collections is to fetch as much information as possible using various means. Collection sources and methods are summarized as follows:

1. **Guided Interview and observation:** During face-to-face sessions of first and second case studies, we had the opportunities to interview participants pertinent to their eLearning process and experiences gained. The interviews undertaken were a guided interview, which were sets of questions asked by the interviewer (in this case the researcher). Questions and answers were more of a discussion and reflecting personal views.
2. **Emails:** Email was one of the most frequently used asynchronous communication among eLearners and the eFacilitator and the most vital source of information collected in all cycles of the case studies. There were two alternative ways for Email communication, i.e. the Email tool integrated into the Blackboard LMS or to use Emails tools which eLearners themselves arranged. Throughout the four cycles of the case studies almost all eLearners were using the later alternative. This was mainly due to the inconveniences that eLearners needed to log on the LMS to read Emails rather than what they were customarily using. Data collected from Email communication were text-based qualitative information.
3. **Online Chat:** The other synchronous online communication was text-based peer or group chat. Though this medium was less formal and used for mere

organisational issues rather than educative discussions, information provided in chat rooms has served as sources of evaluation purpose. During the first and the second cycles of the case studies, the chat tools used were Yahoo messengers, while during the third case study eLearners were using various tools-which posed problems of coordination in order to maintain a common platform. During the fourth case study, eLearners were using the chat room of MOODLE. Data collected from chat sessions were basically on problems of communication and interaction, particularly among groups and setting schedules. Details are discussed in line with the respective case studies in chapter 4 and chapter 5.

4. **Discussion Board:** The discussion board was also one of the most vital asynchronous communication media that was used during all cycles. This tool allowed participants to post comments or question where, other participants of the same discussion board were reading these comments or question and/or replied with their own remarks and opinions.

With the discussion board it was possible to capture the exchange of messages over time. To access resources and to participate in the ongoing discussion on the discussion board, participants ought to be logged into the LMS. Threads of discussion board were organized into categories so that the exchange of messages and responses were grouped together and were easy to find. Classification was based on the discussion on subject matter-related issues and organisational issues; while later in the third and fourth case studies a forum for intercultural issues was added.

5. **Log files:** Log files are traces of access made by a user, which was generated by HTTP servers. Log files are a widely used source of information in a networked environment. There are commonly used log file format, namely classified based on application tools integrated into the LMS and hits recorded each time participants (i.e. eLearners and eFacilitators) log on the system. Log files reveal access information on each user. The first three of cycles of the case studies used the Blackboard LMS (proprietary software), while the fourth used Moodle LMS (from open software foundation). Log files are automatically tracked from the LMS and retrievable by the tutors and system administrators. We have collected vital log files from each participant. Information collected from the log files have been treated as quantitative sources of information.

6. **Personal Home Page:** The LMS offers a space to depict personal information. The information on individual participant's personal home page was also one of the data sources. This was, however, the least used. It has been only used during the third case study. The data collected from the personal home page was more of profile of the eLearners and their favourite links.
7. **ePortfolio:** During the fourth cycle of the case studies, a prototype ePortfolio was used by eLearners to collect, process and publish information on access and use of eLearning infrastructure, self-efficacy to Internet use, group-based eLearning, profile of eLearners and their learning process, and summary of feedback collected from peers and eFacilitators. We prepared a prototype ePortfolio to capture profile of eLearners and their reflections on technology access and use, their ISE as well as reflections on group or collaborative online learning. This was only introduced in the fourth case study, mainly because previous information collecting techniques were not potent enough to allow active participation of eLearners in supplying information.

Information collection mechanisms and sources in conjunctions with the realised case studies are summarised and illustrated below as depicted in Figure 3.7.

Data Sources	Cycle I	Cycle II	Cycle III	Cycle IV
Interview & Observation	X	X		
Log Files	X	X	X	X
Discussion Board	X	X	X	X
Online Chat	X	X	X	X
Home Pages	X	X	X	
Email	X	X	X	X
ePortfolio				X

Figure 3.7: A Summary Matrix of Data Collection for all Cycles

The summary matrix consisting of all methods used to collect throughout the whole case studies. This reveals the efforts made to exhaustively use all possible means to capture information from the eLearning environment and the eLearning process.

Except Email, online chat, discussion board, and log files generated from the LMS, other methods are only used for specific case studies. For instance, during the third and fourth case studies it was not possible to conduct interviews, as there were no opportunities to meet face-to-face with eLearners and the intention was also to focus on other data collection methods. Similarly ePortfolio were applied during the fourth case study, since use of these methods came gradually alongside with learned experiences that necessitated to use ePortfolio to capture reflective feedback.

3.4.2 Data Collection and Processing

One of the most demanding tasks in researches based on qualitative methodology is information processing and conscientious analysis to ultimately capture profound reflections. This was mainly because the information collected in most of the cases were bulky, unstructured. The objective of data collection was to summarize and classify (arrange) collected information in such a way that it should be easily documented for analysis. The discussion on data collection process and analysis was lump summed due to that both processes were done almost simultaneously.

The process of data processing, in the context of this thesis, was a continuous action that started at earlier stage while collecting, memoing and classifying; and ends as late as the concluding phase of the analysis. Analogously, analysis of qualitative information was a continuous process. This has been done with simultaneously analysing collected data such as sequential analysis ⁴ or interim analysis ⁵ that has the advantage of allowing the researcher to go back look for deviant or negative cases and refine questions, develop hypotheses, and pursue emerging avenues of inquiry in further depth [135]. Continuous processing and analysis was almost inevitable in qualitative research since the researcher was steadily collecting the information. It was on this basis that our information analysis was undertaken, to which we were able to analyse information collected from a cyclic action-based case study and situational analysis, based on grounded theory.

Towards this end, the information processing method used for this thesis was the grounding theory continuous processing and analysis [117], which was summarized and depicted below

⁴Becker HS. Sociological work. London: Allen Lane, 1971.

⁵Ibid.

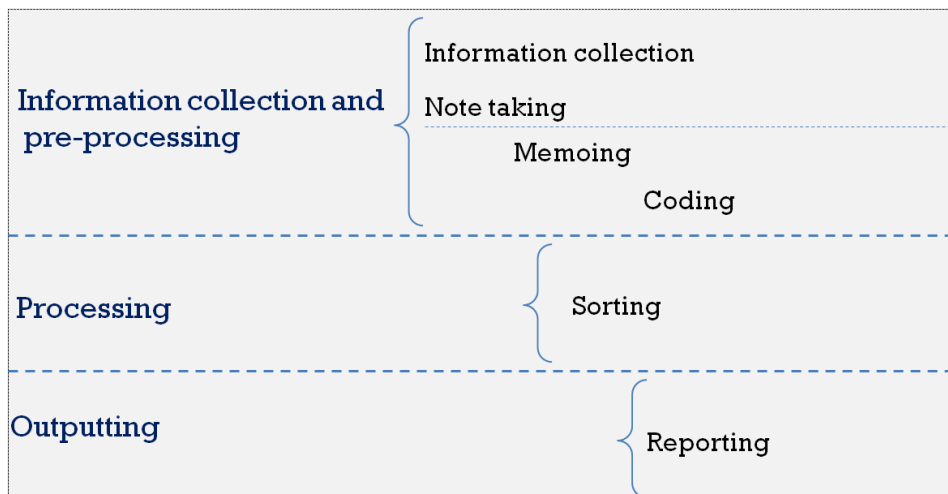


Figure 3.8: Data Collection and Processing based on Grounded Theory (Adopted from Dick, 2005)

The data collection and processing methods using the grounded theory depicted on the diagram Figure 3.8 summarises the measures undertaken during realising the case study. The process, based on the grounded theory methodology, was a continuous and iteratively used in all case studies.

On the other hand, data processing has resulted in an output which was either a report or ready to compile a report document. In our context, it also adds sorting (classifying) and finally conceptual mapping⁶ i.e. graphically classifying the semi-processed or processed information onto the attributes (variables) of the critical success factors (CSF) which are subject to examination.

Therefore, it was worth indicating that information collection i.e., note-taking and coding, are underlined as information collection and pre-processing of information. On the other hand, coding and writing memos can be part of the information processing as well as information analysis in qualitative research such as grounded theory.

3.4.3 Conceptual Maps and Data Analysis

As part of the endeavour to systematically design and logically structure the data collection, processing and analysing, effort was made to summarise and highlight a

⁶This will be discussed in detail in chapter 6 of this thesis.

linear conceptual mapping devised. Effort was made to conceptualise and contextualise structure of the research design at the initial stage. The rest, as Trochim [136] said, "Everything which follows depends on how well the project was initially conceptualised".

Therefore, this thesis designed a conceptual map starting with associating CSF with actors defined and discussed in chapter 3. The overall effort was depicted on the diagram Figure 3.9, which was also summarised below.

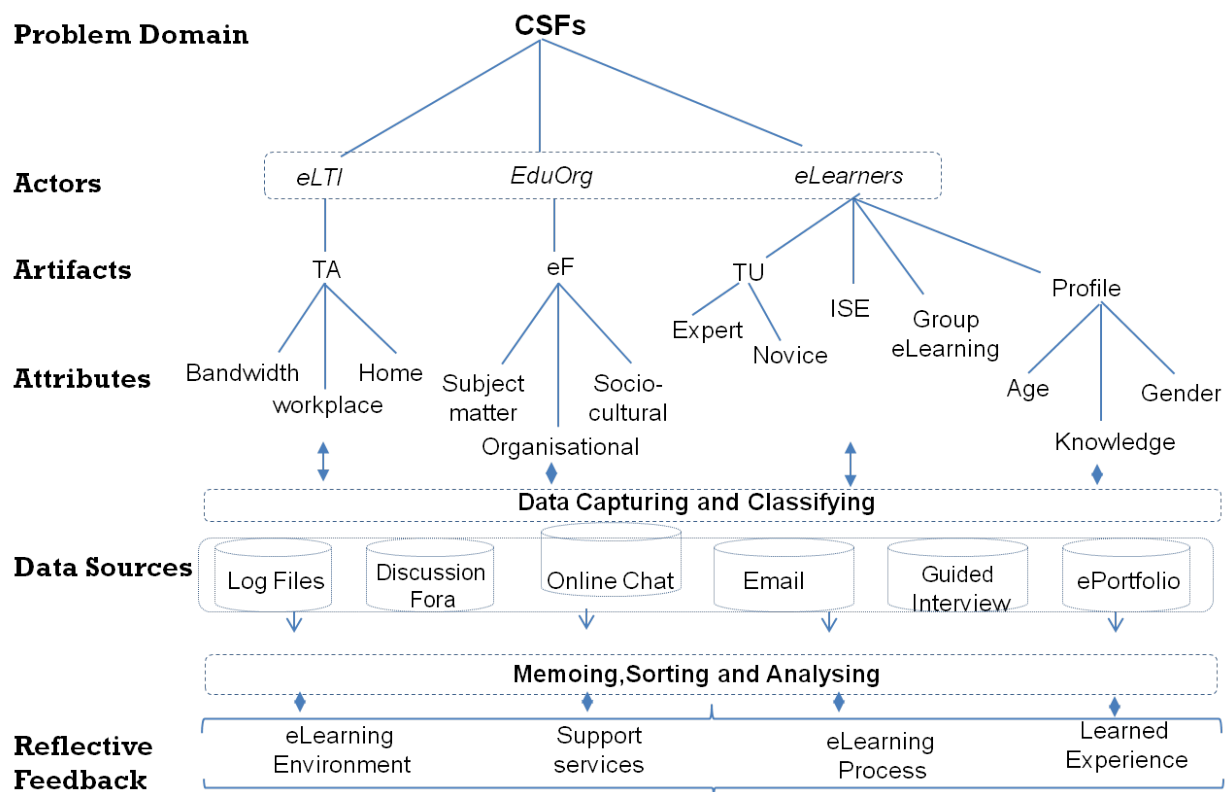


Figure 3.9: Conceptual Mapping and Data Analysis

- The Problem Domain:** The initial conceptual map began with associating CSF, actors, mainly due to the fact that critical success factors are part of the artefacts of the actors. The map connects the actors to artefacts, and then down to the attributes. At this juncture, it can be conceived that the problem definition phase identifies the artefacts as critical success factors, while

the problem abstraction and modelling phase refines the artefacts with a special focus on selected attributes.

- ***Attribute-Data Sources:*** Different data collection methods are selected and, applied phase-by-phase to capture data. Data collected, during the test and evaluation phase, emanated from the attributes. To indicate multiple interaction continuous processes among data sources and the attributes, an interface was required. This was the data capturing, classifying.
- ***Data Sources-Reflective Feedback:*** There was a similar process between data collection and analysis, to which an interface with memoing, sorting and analysing have been devised.

Chapter 4

Case Studies–I-III

4.1 Introduction

This chapter presents three cycles of the four the case studies realised in line with assessment and evaluation of the critical success factors defined and the research questions. The fourth cycle of the case studies will be discussed in chapter 5.

Problems assessed and discussed are based on the research questions raised (chapter 1) and the framework (chapter 2) as well as the methodological approach and research design, i.e. the problem definition, abstraction (modelling) and data collection methods discussed in chapter 3. Each case study has four phases-which constitutes a learning cycle; based on the Kolb's [41] experimental (or learning) cycles as discussed in chapter 2 . These learning cycle are, the problem definition; the problem abstraction and modelling; the implementation and evaluation; and at last the reflections on findings. All in all, each case study applies these four phases of problem solving methods iterative and sequentially.

The initial case study started with the assessment of access for and use to the eLearning technological infrastructure within the context of Ethiopian higher education, defining as one of the critical success factors. Moreover, the problem definitions were devised in such a way that the research question raised in each case study was based on the findings of the preceding case study as well as iteratively assessed the previous problems (i.e. variables defined as critical success factors for eLearning in DCs).

In addition to that, self-efficacy to Internet use was included in the second case study, as accessing and using the infrastructure is dependent on the perception, belief and confidence each eLearners has. The third case study is realised in the context of cross-cultural group-based eLearning, i.e. assessing the access to (TA) and use of (TU) eLearning technological infrastructures and the self-efficacy to Internet use (ISE) in the context of cross-cultural international eLearners from some selected African¹ countries, Ethiopians living in Germany and German life long life wide learners.

4.2 Case study I: Assessment of Technology Access and Use

4.2.1 Introduction

Upon completing the organisational tasks and technical arrangements, the first case study commenced with defining and elaborating the problem statement of the case study to be realised during this period. Subsequent sections are details of the activities carried out in the first case study.

As it has been indicated in chapter one, the first case study was planned to answer the first research question. This has been discussed in the problem definition part. Following that, problems elaborated had been summed up with a conceptual model. Later, the case study implementation and analysis of collected data, as well as the discussion of the findings and reflections have been respectively reported.

4.2.2 Implementation and Analysis

During the implementation of the initial case study there were several arrangements performed. The implementation comprised the field study, setting up necessary facilities, organising sponsoring to supporting material and financial requirement, technical arrangements and coordinating, monitoring, collecting vital data.

¹Kenya, Uganda, Botswana, South Africa, Nigeria, Ghana and Ethiopia - participants of the previous two cycles and others from different regions of the country.

Towards this end some of the vital arrangements done to start the initial phase of the case study were:

- **Building Sponsoring Team:** The first step to start with the case study was to establish stakeholder's team that sponsored and coordinated the case study. The team was established by:
 - Admas University College (Addis Ababa) which provided local assistance to eLearners, particularly a centre of alternative access to Internet and rendered other support services to eLearners
 - Oncampus of the Luebeck University of Applied Sciences (LUAS), which provided the eLearning materials and the learning platform. Beyond that, oncampus has covered most of the costs of the case study
 - Association to Support eLearning and eHealthcare (ASELEH e.V.) in DCs and AB-TIS of Department of Informatics - University of Hamburg which together² initiated the case study and coordinated the implementation
- **Establishing an Advisory Committee:** To keep the quality and widening the impact of the case study, an advisory committee consisting of eight experts and higher officials from different ministerial offices, higher education, business enterprises and think tank institute ³ were established.
- **Technical Arrangements**
 - The mode of the eLearning was set to be a blended eLearning i.e. 80% online and 20% face-to-face). The LMS chosen was Blackboard LMS, a proprietary system which the LUAS, the course provider, was using it
 - Organisation of Internet access centre which also served for the face-to-face sessions and group work at Admas College in Addis Ababa
 - Course Selection: The course for this case study i.e. "Computer Networking" selected which was developed at LUAS and that was offered for the second year to regular eLearning students. The reason behind selecting

²The researcher has represented both institutions

³Ministry of Education, Ministry of Capacity Building, Ethiopian Telecommunication Corporation, Ethiopian Airlines, Development Bank of Ethiopia, Addis Ababa University, and Forum for Social Studies.

this course was similarity of syllable with course provided in most of the Ethiopian universities; relatedness of the course to the case studies objective of assessing technological infrastructure; and to provide participants practical knowledge that may assist them to apply it later in the working environment.

- Organisation of Online and face-to-faces (in Addis Ababa) tutorial sessions organisation and orientation including the kick-off workshop.
- Student support services and eFacilitation, the course organisation, evaluation and certification were presented at the beginning of the study.

4.2.3 Summary of Collected Data and Analysis

To assess the performance of this case study, data were collected based on various methods-discussed in the data collection methodology, as discussed in chapter 3 . In line with this, extensive data, mainly textual, were collected, classified and analysed. A summary of the sources of data and procedures of collecting data were presented below.

1. Guided Interview

Two guided interview sessions were organised during the first case study. The first one was at the beginning of the case study, while the second one was at the end of the case study. The guided interviews were arranged and realised, at the beginning and the end of the case study, as part of the organisation and realisation of the first case study. In short data collected through interview were sorted, and mapped on the critical success factors under evaluation in this phase. Besides, personal profile of the interviewees, prior knowledge on eLearning and their expectation from the eLearning program were also included to get better overview. The second part of the interview was at the end of the first cycle of the case studies mainly on the access to and use of technological infrastructure, on support services and group communication and interactions; fulfilment of expectations.

Data collected through guided interview are:

- **Personal Profile:** Information collected under personal profile is used to individualise the feedback as well as encourage self-expression or self-evaluation. This includes age, gender, academic background and skill related to ICT and Internet.
- **Access to eLearning technological infrastructure (TA):** The focus issue here was what type of connectivity (narrowband or broadband) do eLearners have to access Internet (at home, workplace or Internet Café and if they were using PC/Internet access shared or singly owned. Access to Internet at workplace was reported by the eLearners during the guided interview indicated that they have a varying degree of access to Internet, ranging from narrowband to broadband Internet connectivity. On the other hand, pertinent to access to Internet at home was almost (over 71%) a dial-up connection with a max 56 K/bits. With this, eLearners were only capable to access Email, but had reported difficulties to access the LMS.
- **Use of eLearning technological infrastructure (TU):** In this category, the interviewees stated their skill to use of the Internet browser and different tools. All of them revealed that they did not have any problem with Internet use.
- **Prior knowledge on eLearning:** Participants have indicated that none of them had experience with eLearning and hence never used a LMS.
- **Expectations:** From those participated in the guided interview, 43% of emphasized that they were simply excited to know what eLearning would look like, whereas, 57% were interested more to the content of the course.

Similarly, those seven eLearners were interviewed at the end of the eLearning course. This was during the first face-to-face tutorial session. The main focuses of this guided interview was about their experience, problems in access for and use to the LMS, communication with their peers and at last about the tutorial and overall support services during the course time. The questions were more or less similar, except that this time the focuses were on their experience, satisfaction/disappointment, and problems. The following were the findings.

- **Access to eLearning technological infrastructure (TA):** Access to Internet was difficult for almost all of the course participants. It was also observed that those who are employees of International organisation, such as the

United Nation had broadband Internet access at their workplace. All in all, access at home for all interviewed eLearners has been found slow, to which eLearners explained their dissatisfactions with access the LMS. Moreover.

- Use of eLearning technological infrastructure (TU): All have revealed that they have increasingly improved their skill in Internet use in general and the eLearning environment (offline as well as online).
- Experience and knowledge gained from the eLearning program: all of them have appreciated the eLearning course. However, three of them found that eLearning was tough compared to face-to-face.

2. Email

During this course, a total of 193 Emails were exchanged. This was nearly 10.7 Emails per participant for the whole course duration. This made that on the average each participant had sent less than one Email per week.

On the other hand, it was only 118 (i.e. 61%) of the Emails exchanged which contained information on the TA or TU directly or indirectly. The rest were mere personal communication not relevant for assessment issues related with TA and TU. To this end, summary of the Email exchanged is given below:

- Access to eLearning technological infrastructure (TA): The content summary of the exchanged Email pertinent to TA were evident that most have highlighted what type of access they had (narrow bandwidth or broad bandwidth) or from where they usually access their Emails. In general, nearly all agreed that the Email communication was not easy, due to connectivity problems, but Email communication was better than online chat or the discussion board.
- Use for eLearning technological infrastructure (TU): Similarly, information pertinent to eLearners skill to effectively use either the Email tool or the LMS or even Internet browser, were not easily traceable from the Emails exchanged. In fact those who had problems to access and use the LMS reported through Email. On the other hand, it could be assumed that those with the necessary skill and experience Internet use, were communicating through either Email or discussion board.

3. Discussion Board

To use the discussion board, it was compulsory to log onto the LMS (i.e. the Black Board). This was not easy for many of the participants due to slow Internet connectivity, as most were using narrow bandwidth (i.e. dial-up connection). Therefore, discussion board was not frequently used. As a result, eLearners had to choose Email as ideal communication media. On the other hand, regarding the content of the entries on the discussion board, it is seen that, they were more or less similar to those sent through Emails.

All in all, there were a total of 57 entries on the discussion forum. Of which 38 entries (i.e. 65%) entries were on discussion about the subject matter and the rest 19 entries (i.e. 33%) entries were on organisational issues.

Issue related with TA and TU were seldom discussed in this forum. The discussion board had rather served to discuss subject matter (65% of the total entries) related issues i.e. on assignments, and discussion on the content of the course.

4. Chat

Text-based online chat using the eLearning room (i.e. the tool integrated into the Black Board LMS) was never used during the first case study. The main reasons were, first, it was connectivity problems, i.e. slow connection and the difficulties in downloading Java-Plug-in (heavy weight byte-code). Secondly, eLearners preferred to use Yahoo-Messenger.

Thus, a weekly chat schedule, using the 'Yahoo Messenger' was arranged for all participants. Out of 14 chat schedules (appointments), only 8 of them were realised; which was only 57% of planned schedule. Average participant per session were of 27% of the total participants.

Contents of texts collected from the online chat sessions revealed problems of connectivity and also difficulties to effectively use the functionalities of the tool. Four eLearners have preferred to use a voice message, but it was difficult to materialise due to connectivity problems. Two had suggested using Skype, this was also not possible, because of the bandwidth and also access problems.

5. Log Files

Eighteen eLearners were regularly accessing the Black Board LMS. Automatically generated log file statistics fetched first cycle of the case studies, a total of 4,678 hits were recorded. This constituted about 260 hits per eLearner during

the whole course time. This was meant 2.4 hits on the average per day per user. Actual hits per eLearner vary greatly: ranging from 1042 (22% of all) maximum and exceptional to 70 the lowest hit.

The hits were classified into two major categories, namely application areas accessed and temporal, i.e. hits per day and per hours.

- **Application Areas:** Application areas are tools integrated in the LMS, where eLearners have access for various purposes, announcement, discussion board, chat, course content areas, etc. Access to any application area is counted as hits. In line with this, the hits recorded were 51.8% (2423) hits were the Discussion Board and the announcements hits 15.28% (715) and hints followed by Content Area 4.7% (220). Towards this end, there were many tools and features integrated in the LMS which were not used, such as: Address Book, Calendar, Chalk Title Management, Collaboration, Roster, Drop box, Homepage, Groups, Gradebook, Performance Dashboard, Personal Information, etc.

Graphically, the hits to application areas looks like depicted by Figure 4.1, i.e. access to application areas on daily basis are shown.

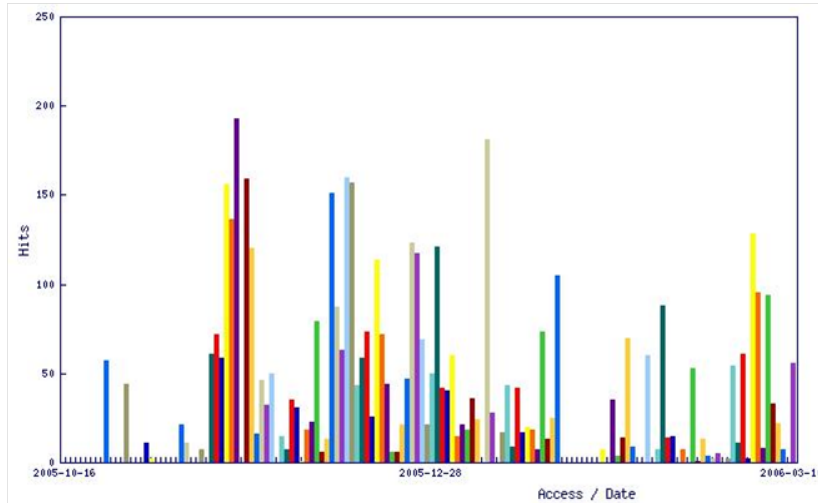


Figure 4.1: Log file- Case study I: Access to Application Areas

- **Daily Basis:** the log files shows that the LMS was accessed every day (i.e. Monday to Sunday). Access on Saturday and Sunday was relative high, while on Tuesday is, on the average low. This was explained by

eLearners, at weekends they either meet at the Admas computing centre or visit Internet Café.

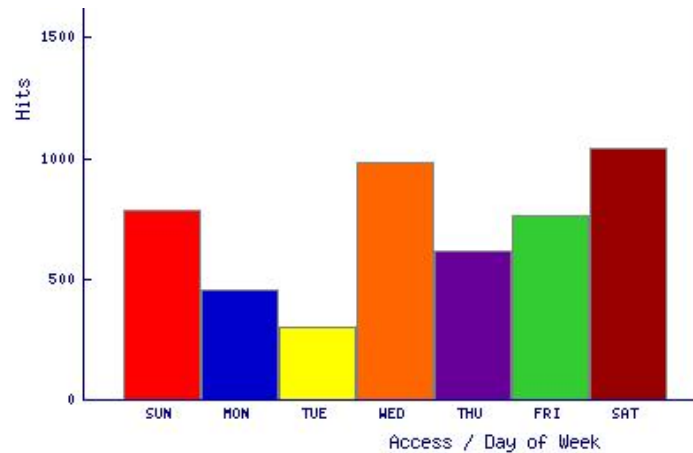


Figure 4.2: Log file- Case study I: Access to Application Areas/Week-Days

- Hourly Basis: Based on the log files collected, busy hours were early morning (about 7 a.m. CET) and beginning mid-day. The span of time hit recorded was from 5:00 a.m. to 8:00 p.m.

Access to application areas on daily and hourly basis shows that it seems most course participants visited the LMS at their office during or shortly before the end of their working hours.

The summary of the log files diagrammatically is provided in Figure 4.1, Figure 4.2 and Figure 4.3.

4.2.4 Findings and Reflections

Effort was made to summarize, classify and sort (map) vital data collected into two major critical success factors, i.e. TA and TU, and analyse the findings. The analysis and reflection was based on the methodological approach and the theoretical framework.

The main investigations in this case study were to identify where and how do eLearners access the eLearning environment. Through collected and analysed data, access to

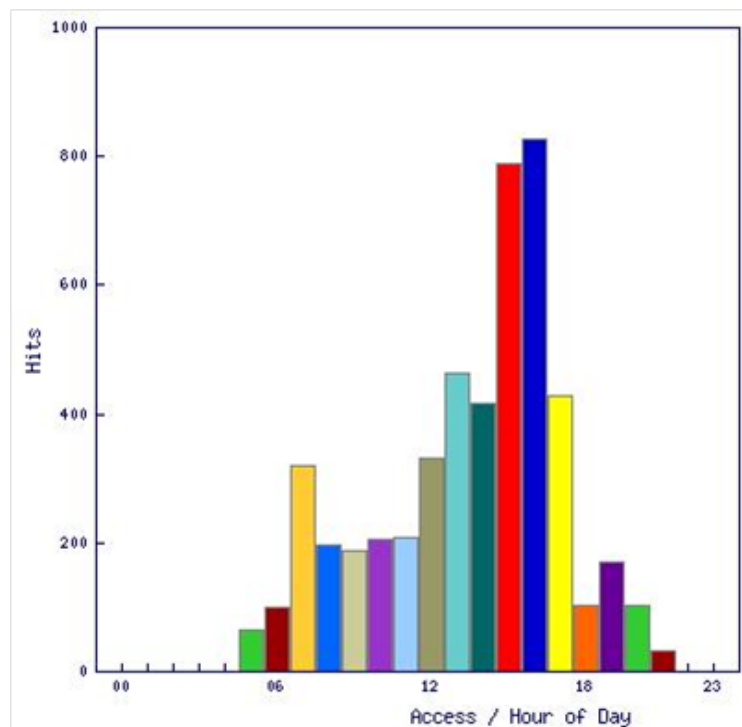


Figure 4.3: Log file- Case study I: Access to Application Areas/ Hour

eLearning environments was either from the workplace⁴ or at home or using Internet Cafés⁵. Majority were having access either at workplace or Internet Café Connectivity at home was used by few only to access Emails.

On the other hand, revealing the TU was not easier. On one hand, the collected data contained more on connectivity problems. On the other hand, variables or type of skill, i.e. novice or expert were not clearly understood. Yet, with the elapse of time users were developing their skills.

The findings from the summary of collected data was depicted in Figure 4.4. The collected data indicated that access to the LMS was difficult. This was shown by a broken red line connecting both eLearners (human actors) and LMS (technology actors) Communication with eFacilitator was through Email, and face-to-face. Communication among eLearners was mostly rendered by face-to-face meetings.

⁴University students applies the computing or Internet centre rather than workplace. However, for the sake of simplicity, it was lump summed as workplace.

⁵Which would never be seen as a problem by eLearners in industrialised countries.

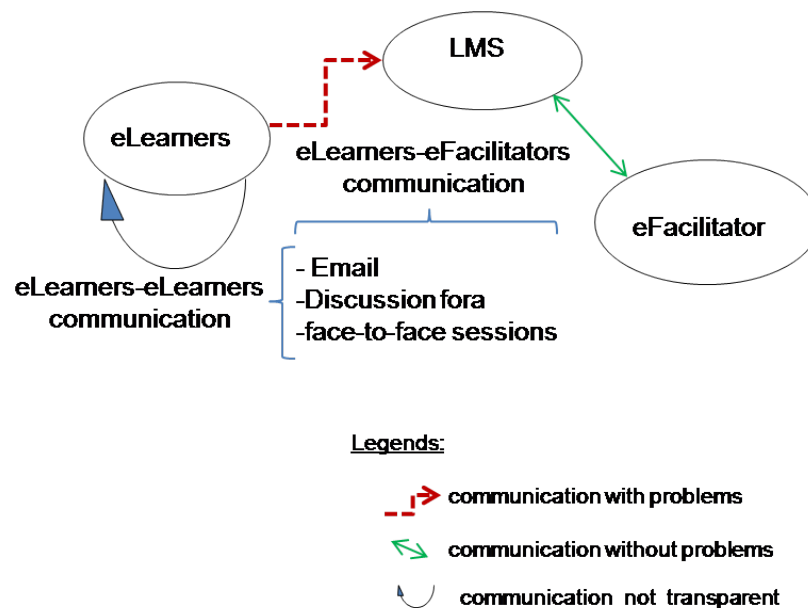


Figure 4.4: Findings form Case study I

The findings from the first case study were the learned experience gained. These are that research has seen the enthusiasm of eLearners to the relatively new type of access to tertiary education, i.e. eLearning. The encouraging reflective statement from eLearners at the end of the case study was:

Thanks for the education system you brought to us!

Coupled to that, the awareness created to eLearning through this course (case study) has been broader than expected. This had been revealed during two workshops organised after the first case study: Participants were eLearners from this course and other invited eLearners from the African Virtual University (AVU), affiliated with Addis Ababa University. The second workshop was with the member of the advisory committee (from various institutions-as enlisted previously) and invited guests, from UNESCO, UNDP, GTZ, etc. Participants from AVU have reflected on the tutorial session and the eLearning case study as follows:

Participants from AVU have reflected on the tutorial session and the eLearning case study as follows :

"We find it very interesting and we happy to participate

to this workshop. It is different from what we have at the AVU. Thank you!"

On the other hand, feedback was also collected (from the informal discussion) from invited participants and members of the advisory committee. In this regard it is worth mentioning what an invited guest from UNESCO has commented as:

"interesting and eye opening!"

4.2.5 Concluding Remarks on Case Study I

As stated previously, major objectives of the first cycle of the case studies were to attain two goals. The first was; at conceptual level, identifying the main actors and the network of actors⁶ and vital artefacts, as well as highlighting and analysing the functional relationship among these actors within the network. The second goal was, at the practical level, to identify, define, model, implement and evaluate and analyse findings related with the critical success factors TA and TU. Both were attained to reveal the TA features. Nevertheless, it was decided to reiterate the assessment with a second case study to reassure the results achieved.

Therefore a second case study of the case study was found vital to continue with the investigation with TA and TU. Moreover, it was also necessary to widen the scope by including new CSF that were related with problems seen during the second case study, i.e. eLearners Internet self-efficacy that ought to be verified along side with TA and TU.

4.3 Case study II: Assessment of Internet Self-Efficacy

4.3.1 Introduction

The second case study was a continuation and an extension of the first case study; based on two arguments. The first argument was to repeat the assessment began

⁶An actor may consists of a network of actors as well as various artefacts.

during the first case study to reassure what has been observed and what was not achieved. The second argument was that technology use should be assessed not only from the data collected from actual use, but it also shall be seen from the point of self efficacy or the belief and perceived knowledge declared by users.

Therefore, coupled with assessing the TA and TU, it was vital to observe the Internet Self-efficacy (ISE). During the second cycle of the case study, effort was made to initially define and elaborate the problem domain and the research question (i.e. the second, in the list of the research questions stated in chapter 1); and then abstraction of the problem discussed while designing a model (i.e. extending the model used during the first case study), as discussed in chapter 3 ; followed by a discussion on the implementation, analysis on collected data. The section finally closed with a summary of the findings and reflections of the overall implementations and findings.

4.3.2 Implementation and Analysis

The implementation phase of the second case study was more or less similar to that of the first case study as it was a direct extension. In other words, the eLearners (course participants), the institutional framework, the eLearning environment, etc. were all similar. Slight changes prevailed were the focal point of assessment and the course-which, indeed similar, but was second part of the Computer Networking.

4.3.3 Summary of Data Collected and Analysis

During the second cycle of the case studies, effort was made to collect data pertinent to access to and use of technological infrastructure for eLearning and self-efficacy to Internet use. Data collection methods and instruments in the second case study have also remained similar to the first case study. However, the focus and the content have been concentrated on the ISE.

Data to assess ISE was collected through questionnaire. Effort has been also made to document and summarise information from various sources, such as Email, Chat, discussion fora, and log files, to assess the TA and TU parallel to ISE. Summary of data collection methods and sources are presented as follows.

1. **Guided Interview and Observation**

One interview session was organised during this case study. Seven eLearners participated in the guided interview during the second case study. Five of them being those who participated during the guided interview in the first case study, while the rest two were randomly selected from group who had not been participating previously. The interview was similar to the first one guided and interviewers were the same. However, questions asked were mainly focussed on the ISE of eLearners. The questions were taken from standard ISE questionnaire used by various researchers.

Collected data indicated, based on the questions asked, showed positive attitude, belief and confidence of eLearners towards Internet use for eLearning.

2. **Email**

During the second case study, Email communication was limited. It was only a total of 251 Emails collected. Of which 178 (71%) were evaluated. This was approximately on the average about 19.3 Emails per participant for the overall duration or on the average 1.4 Emails every week per eLearner. This was higher than the first case study. This was mainly because, almost all communications, excluding the face-to-face sessions, was through Emails.

Contents of the Emails exchanged relevant to the problem domain under study, i.e. ISE was also considered. Most of the Emails exchanged and issues related with ISE had been searched. On the other hand, the questions pertinent to ISE were related to personal opinion of own confidence and belief, while the Email exchanged were public, where individuals' capabilities, confidences and beliefs in Internet use for learning was discussed. Therefore, ISE data collected through were less potent to find the desired information.

3. **Internet Self-efficacy**

Data related to self-efficacy to Internet use were collected through all envisaged methods. Vital source was, however, interviews. As it has been cited in chapter 2 contents of the ISE were mostly on eLearners' assessment on their capabilities to effectively use Internet, i.e. operative knowledge.

According to data related to ISE collected, 56% out of thirteen participants have indicated in all measures a higher level of ISE. On the other hand, 28% of the

eLearners had strong belief and confidence to easily use most of the of Internet related applications including the LMS.

4. Discussion Board

As access to the LMS was limited, use of the discussion board was also quite restricted. In this case, there were only a total of 33 entries in the discussion forum from the Blackboard LMS. This is 42% less than the previous case study. This makes it, on the average about 3 entries per eLearner which was again near one entry every month. On the other hand 82% of the entries were only organisational issue, of which 74% were from the eFacilitator. Therefore there were insufficient inputs or feedback from the eLearners.

5. Chat

Text-based online chat was also not frequently organised. There were a total of seven sessions organised, which is less than 50% of the first cycle, in which there were only six eLearners participating, almost at the end of the course. Otherwise, there were one or two participants. The discussion was also mainly on access problems and, indeed, there were interruptions several times.

The first three chat sessions were in mid-May followed by mid-June 2006. Then the rest were beginning June and August, while the last two were in September. During these online discussions over 800 entries were recorded, where 53% were in September while discussing on the last examination. Of which 25% discussions were on worries about less participation in online discussion i.e. discussion forum, Email exchange and Chat.

6. Log Files

Log files were regularly fetched from the Black Board LMS on various application areas. Application areas are tools integrated in the LMS, where eLearners have access for various purposes, announcement, discussion board, chat, etc. as discussed in the previous case study.

The statistical information collected were those summarized from log files and quantified data. The aim of distinctly revealing the quantitative data in the information system was to supplement the qualitative research analysis.

As a result, the summary of the content of the information collected, chiefly through interviews and personal observations were summarised as follow:

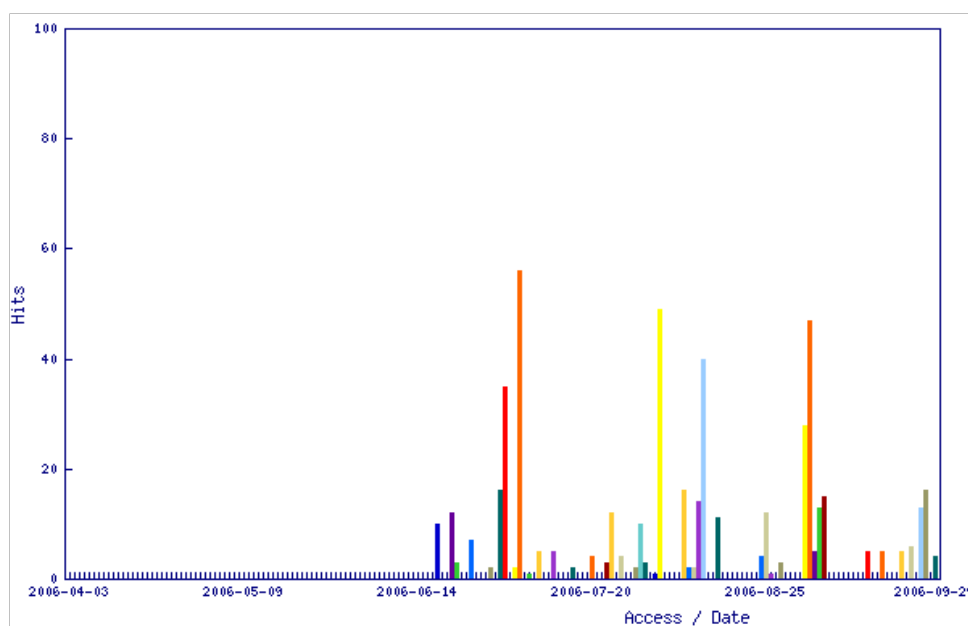


Figure 4.5: Log file-Case study II: Access to Application Areas

As provided in the diagram, 362 out of 1611 hits, which was 32.2% were from instructors. On the other hand 739 hits or 64% hits were from 29% of the participants. This shows that the number of hits counted were not evenly distributed.

4.3.4 Findings and Reflections

This part sums up the findings and reflections on learned experience while conducting the second cycle of the case studies. The findings and reflections were summary of the collected data and analysis. Reflections from eLearners on some problems as well as reflections of the research were presented.

Based on collected data, over 87% of eLearners had access to Internet at workplace, of which 72% had broad bandwidth. On the other hand approximately 70% percent had Internet connectivity at home, however, all of them reported that it was narrow band and quite difficult to access the Black Board LMS at home.

Access to Internet to use the LMS and other communication media (Email and other Instant Message) were very limited. The eFacilitator was often writing to participant's questions like:

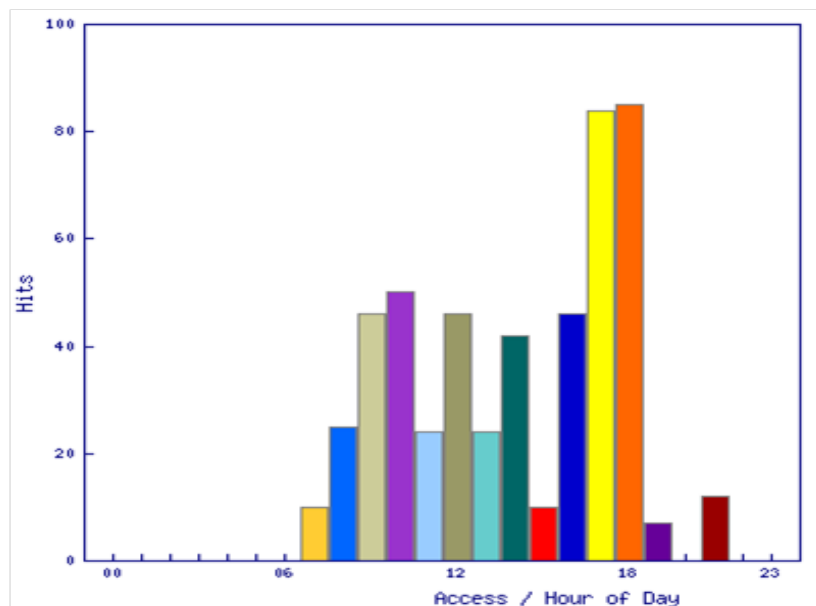


Figure 4.6: Log file-Case study II: Access to Application Areas/Hour

"what were the reasons for eLearners not accessing the LMS and not responding Emails or requests on the discussion board?"

Responses of four eLearners were:

"You might not know how difficult was to access Internet these days. Even the power down aggravated the problem".

While the other one responded as:

"Let's break the silence! Although we have difficulties with connectivity to the LMS, we could have exchanged Emails".

Yet, another interesting issue raised was what eLearners, as lifelong learners having other engagements, might be busy on other tasks. So, coupled with slow connectivity, the motivation to communicate might have contributed to less interaction. In this connection an eLearner underlined that:

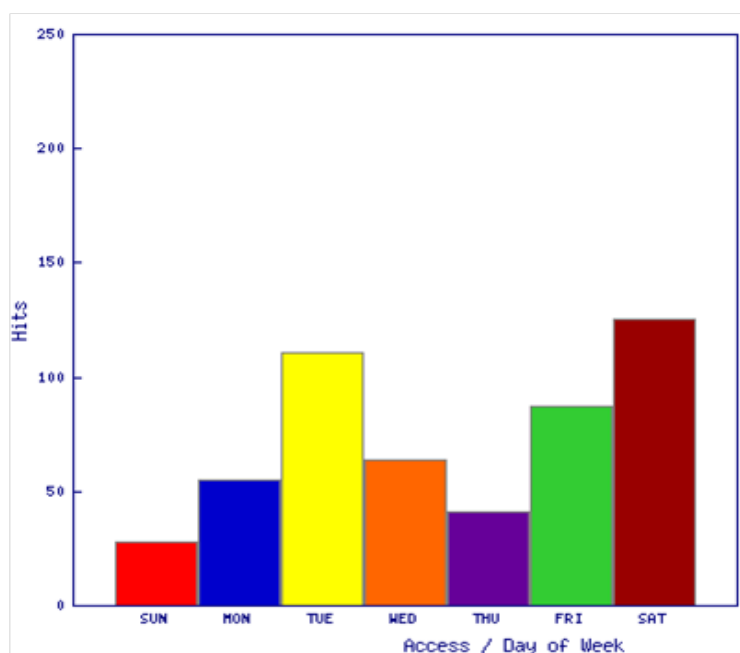


Figure 4.7: Log file-Case study II: Access to Application Areas/Week-Days

"From what I have noticed some of them were busy (mainly lack of time for this pilot course) on job, family, social affairs, etc."

Critics on the support services from the eLearning coordination and newly prevailing restrictions of the government towards Internet users was sent through an Email from one eLearner.:

"But the local support service has been also decreasing and connectivity problems, associated with the new prevailing government policy towards restricting on the use of voice over IP, such as Skype, SMS, has all contributed to declining motivation."

All in all, access to the eLearning environment has decreased, as it was seen from the log files, while Email communication, as a better alternative, had increased. With this, the access to the LMS remained constrained, coupled with declining communication. And that the face-to-face communication had increased. The whole findings were depicted as: Figure 4.8

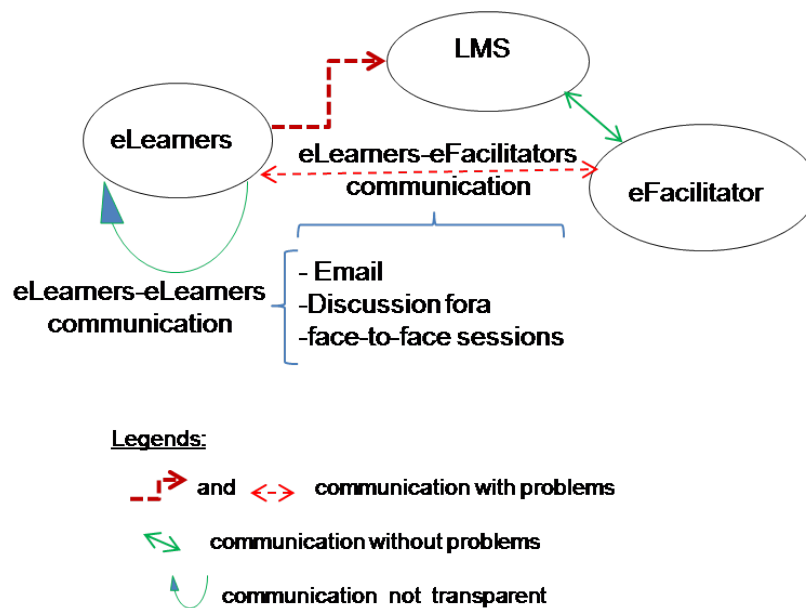


Figure 4.8: Findings from Case study II

Information on TU and ISE were satisfactory, in a sense that intended information was collected. Collected data related to ISE showed that 87% of the participants expressed that they have confidence in effectively using the Internet infrastructure to access the LMS and communicate with peers. Besides, 91% of the course participants have reported that they have newly developed skills regarding Internet use.

4.3.5 Concluding Remarks on Case Study II

Pertinent with TA the findings from this case study showed that communication and interaction was not only insufficient, but also had decreased compared with the first case study. One of the reasons was, that participants of the case study were from Addis Ababa and the surrounding, where they were meeting face-to-face for group learning and there was no need to use LMS. Neither the LMS nor other means of technological infrastructure was effectively used, as it has been turned into a face-to-face learning mode. Participants meet nearly every week regularly and there was an assistance who offers tutorial services. Hence, the envisaged aims of this eLearning case study were not attained, i.e. access to the LMS and communication an interaction have rather declined more than that of the previous cycle.

The eLearning process and the access and use of technology were less transparent than expected. Based on log files, eLearners visit to the LMS has drastically decreased. As already stated the main reason was eLearners have managed and preferred to meet face-to-face at the eLearning tutorial centre at Admas College than to communicate and interact online. Therefore, with all the improvements in online learning, the objective of the case study was not met. Hence, it was decided to launch a third case study with intercultural and international participants including the previous participants.

4.4 Case study III: Assessment of Group-Based eLearning

4.4.1 Introduction

The third case study was initiated based on the findings from the second case study; and the need to assess the eLearning process and environment in the wider range of participants with multicultural background. It is mainly focussed on a cross cultural group or collaborative online learning, which was defined as one of the critical success factors in the development of eLearning services. With this, the third case study assessed the TA, TU and self-efficacy to intercultural group or collaborative online learning.

The third cycle of the case studies has also assessed the eFacilitating for larger groups of group-based online learners those with not only different cultural backgrounds, but also participants with varying TA (connectivity) and TU (skill and experiences). Data collection and assessment have been conducted self-efficacy to group learning aside from ISE. Thus, the model used during this case study was broadened with group-based learning.

The context of this part of the case study was focussed on the higher education learning institution, from eight countries (seven African-including Ethiopia) and Germany.

4.4.2 Implementation and Analysis

Organisation and Implementation

Widening the scope of the case study, the organisation aspects of the third case study has also become bigger and more challenging. The challenge began with the conceptual setting, i.e. choice of course participants, recruiting, selection of course, mode of eLearning, course evaluations, eFacilitation with bigger groups, etc.

The online course was "Fundamentals of Computer Science" - developed for first year students at the Luebeck University of Applied Science, and the LMS system remained Black Board as before.

Course Selection and Objective: The course offered was Fundamentals (introduction to) of Computer Science, which was a basic theoretical course. The course will be only offered online without any presence session, mainly because of the highly distributed nature of participants. Online tutorial will be provided with two instructors. There will be no written final examinations, but to evaluate final outcome of the pilot project, different strategies were designed, of which group or team work will be one of the main tools.

eFacilitation and Coordination : For this case study there were two online eFacilitators (the researcher of this and the author of the course), mainly because of larger number of participants and the need for intensive eFacilitation. In order to effectively coordinate the course, eLearners have been classified in eight small learning groups, for which one group leader for each group was elected by the group members.

Course Assessment: Course participants were evaluated based on assignments sent by the groups, as well as individual participants' contributions to solve each assignment.

Setting the Timeline: Central focus of the organisation and implementation of the third case study was to register intercultural participants from different African countries to broaden the assessment to eLearning in DCs.

Recruiting Participants: The strategy was to recruit participants mainly from different African countries. An announcement notices were distributed in different ways through different means. Announcing on an International Conference on African Civil Societies Organisation in Addis Ababa-Ethiopia has assisted to have contact

with many people from various African countries. As a result course participants from six African countries have been registered, including the previous participants from Ethiopia. Besides, it was also sought to have more participants from Ethiopia from various areas and groups. Therefore, additional participants were registered from Addis Ababa, Bahr Dar, Gondar and Mekelle. All in all, 66 participants from 8 countries: 7 African countries (Ethiopia, Kenya, Uganda, Botswana, South Africa, Nigeria and Ghana), and Germany were registered.

Group formation: Group or collaborative online learning was the basic focus of this case study, where participants from different cultural background were classified into eight various learning teams, each consisting of eight participants. The group formation was done based on purposive sampling in such a way that it had served the research objective of this case study.

4.4.3 Summary of Data Collected and Analysis

As it had been practised in previous cycles, collected data were summarized, classified and analysed. Summary of the collected data and analysis were presented as follows.

1. Email

During the third case study 435 Emails were exchanged among 42 participants, although there were 66 participants at the initial phase, 8 were dropped out, and the rest were passive. Thus Emails exchanged were considered from 42 active participants. This indicated that 10.4 Emails per user which makes it 1.6 Emails per week per participant. This has improved over previous cycles. During this case study, 398 (92%) Emails had been exchanged using Emails outside of the LMS, mainly Yahoo. At last 258 Emails were found relevant.

2. Discussion Board

The discussion board, as part of the LMS, had been organised in three major categories, namely the organisation, the subject matter and the socio-cultural issues (new features in the discussion board). There were a total of 118 entries (messages) found on the discussion board, to which 55% were on organisational issues while the rest 40% and 5% were on subject matter and socio-cultural issues, respectively.

Issues on organisation were mainly on group formation and coordination. Issues related with socio-cultural issues were less discussed, despite the fact that there were participants from different cultures.

3. Chat

Text-based online chat as well as voice-message had been tried at different times and phases of the course. However, organisations of chat were difficult due to various tools used and different preferences, as well as problems of connectivity to the chat tool integrated into the Black Board LMS.

Participation in text-based online chat was quite limited as well as difficult to coordinate since different participants use different tools. It was mostly a similar group of eLearners who were participating in chat sessions. For instance on June where 25 participants were logged on three different chat rooms, totally different and difficult to coordinate, i.e. Skype, (most participants from Africa with expectation of Ethiopia), Chat room of the Blackboard LMS (mainly participants from Germany) and Yahoo Messenger (all from Ethiopian, except one participant who did log on the LMS).

All in all there were 24 chat sessions organised during the 10 weeks course duration, i.e. 2.4 times a week. On the other hand, there were over 1,280 entries and on the average five participants to each session. 710 (55.5%) entries were relevant and hence vital information had been manually fetched, sorted, and mapped on the critical success factors assessed during case study, i.e. G-eL. Total relevant entities were 491(69%) entries had contents directly emphasising problems of group-based learning, due to mainly less or lack of participation from group mates.

4. ISE

Data on eLearners' ISE had been collected in various ways i.e. through discussion (individualised), and Emails as well as questions 88% eLearners participate had reflected their positive as well as high level of ISE.

5. Group-Based Online Learning

Data on the attitude and experiences of group-based online learning had been also collected in various ways, i.e. through group discussion, individuals' reflections, and group leaders' opinion. On the other hand, information related with

group online learning had been also fetched from discussions, Email, and chat, while major theme of focus and discussion was on group online learning.

In this case, six out of eight group leaders have reported (written statement) on activities of their group specifically on problems and challenges, such as lack of communication and motivation. One group leader, a group consisting of participants from different countries, i.e. two Ethiopians, two Germans, one Ethiopian living in Germany and one from Botswana have had a positive experience.

On the one hand, a group from Mekele, all participants living there and were frequently organising a face-to-face meeting had reported there had been no problem related to group assignment. Nonetheless, this has less to do with cross cultural group-based online learning.

On the other hand, communication interactions among extra-groups (i.e. the overall group) were quite limited.

6. Home Page

During the third cycle of the case studies, 21% of the total active participants have posted personal and professional information on the students' home page integrated into the LMS. These were 30% from Ethiopia (one from previous case study), 30% from Germany, 10% from Ghana, 20% two from Kenya. Despite their effort, students home pages were less visited, mainly because, some were not aware, others had difficulties with accessing the LMS.

7. Log Files

During the third case study there were a total of 18,040 hits on the LMS. Of which all participants, 16.7% never logged on the LMS, of which approx. 70% were participants from Ethiopia. Again 40% of the Ethiopians who never logged on the LMS were participants of the previous two cycles. The reasons given by the participants were difficulties in Internet access, the course was not interesting enough and time constraints. Surprisingly, it has been observed that participations from the previous two cycles were generally weaker.

Over 50% of the participants have seldom visited the LMS (i.e. less than 130 hits), while only 30 % of the course participants have frequently accessed the LMS (i.e. 13.6% between 155 to 327 and 16.7% between 600 to 1500 hits). Students over 1000 hits on LMS equals 6.4% (two Germans, one from Kenya and one Ghanaian living in USA).

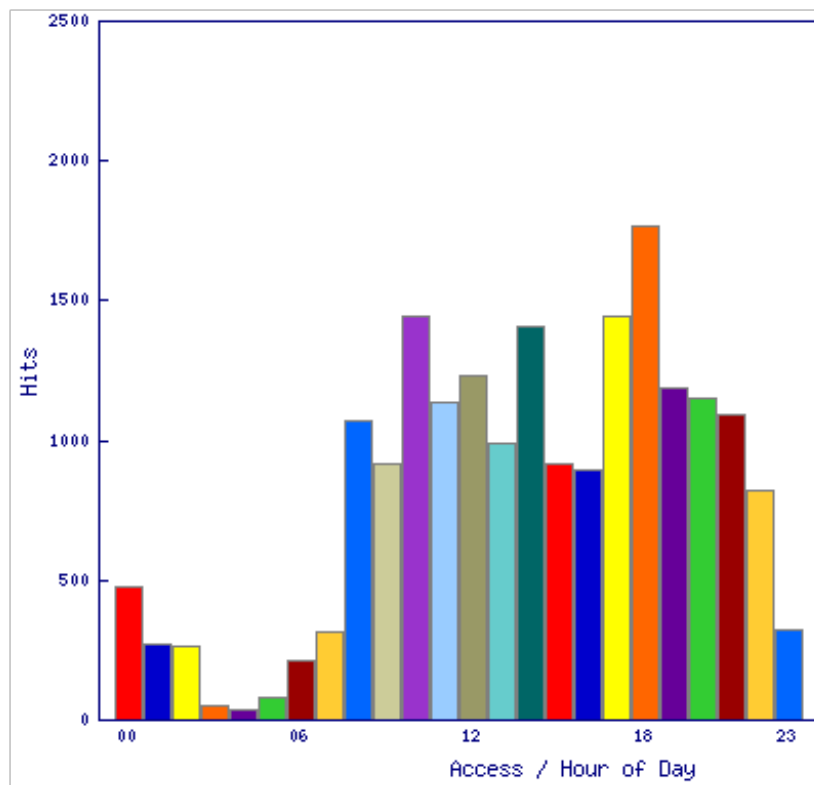


Figure 4.9: Log file-Cycle III: Access to Application /Week-Days

The hourly basis access to LMS showed that eLearners have accessed the learning platform twenty four hours a day-signifying a typical feature of an online learning with international course participants. This indicates also the time zone effect. The peak time was around 6:00 p.m. On the other hand, high density of access between 8:00 a.m. and 3:00 p.m. witnessed that most participants have access at work places.

On the other hand, from the point of the daily access to LMS, on the average Monday showed high cumulative points by far. This also may be one reason to substantiate access at workplace and eLearners might have accessed the LMS to retrieve what has been going on at weekends. In this case, obviously access hits at weekends have mainly emanated either from those who have access at home or from Internet Café users.

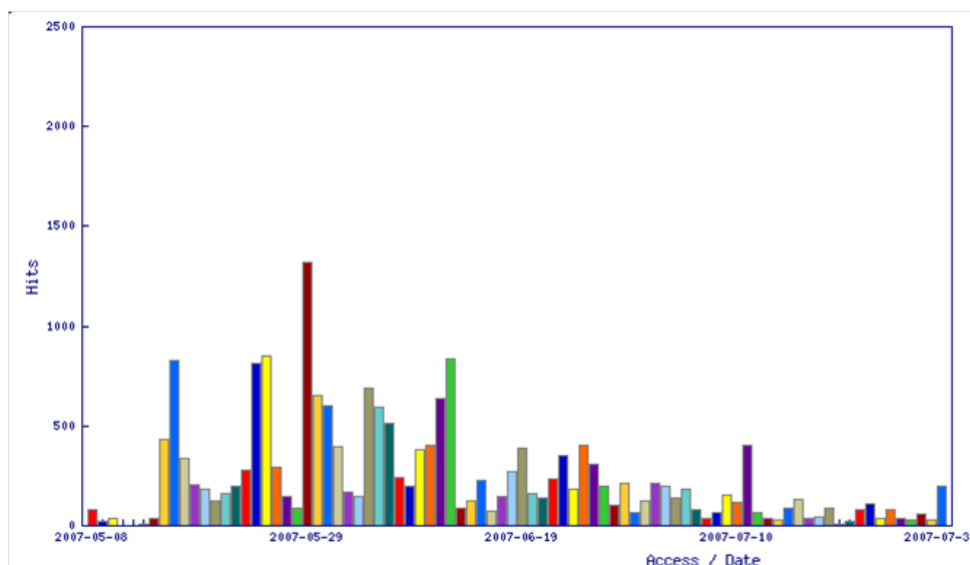


Figure 4.10: Log file-Cycle III: Access to Application Areas

4.4.4 Findings and Reflections

During the third case study effort was made to register participants (i.e. eLearners) from different culture and provide a course without any face-to-face meeting. This was the first experience, not only for the researcher, but also for the course provider, the Oncampus of the Luebeck Universities of Applied Sciences. Most participants were also excited, despite the fact that there were several drawbacks, due to difficulties in communication and interactions, emanated from connectivity problems. That said, the findings from the third case study can be summarised as follows.

Profile: Based on the collected demographic data course participants were between 20 and 56 years of age, where, nearly 60% were under 30 years old, while only 6% were 35 and above. The share of the female participants was only 24%. The educational background showed that nearly 40% were graduates ranging from B.A / B.Sc. to M.D., whereas about 13% were university students.

Technology Access and Use: on the average, 61% of the participants have Internet access at home, while 30% have access only at workplace. On the other hand, 55% of the course participants could access the LMS at home while 63.6% access the LMS at workplace. Of which 63.6% broad bandwidth at workplace, whereas 18.2% use dial-up connection. Nevertheless 25.0% declared that they read Emails only twice a

week, whereas 12.5% once a day.

Group-based Online Learning: 84,8% have already experience in group work directly or indirectly. Reactions to online group shows that 53% of participants agree to higher degree or strongly agree to online learning group learning. On the other hand 15,2% strongly disagree to online learning group learning. However, 60% of these participants believed that group learning in face-to-face was more effective than online learning.

When it comes to culture and language as hindrance factors to group-based online learning, eLearners responded as language was more decisive than culture, i.e. 76% disagree similarity of cultural background as prerequisite for online collaborative on-line learning, while equally 76% agree that language competence (in chosen common language) was vital.

In a nutshell, during this case study access to the LMS was observed. Although, connectivity problems were inhibiting factors for many participants from Africa, over 45% of participants from Germany were reluctant visiting the LMS. On the other hand, there were participants from Kenya, Ghana, and Ethiopia who were frequently accessing the LMS.

Group-based online learning had suffered due to inequality of participation that emanated mainly from two reasons: less motivation and difficulties in connectivity. Finally, the setting in communication and interaction showed that, as depicted in Figure 4.11, interaction and communication over the LMS has been different from previous cycles. In fact, participants from the previous cycles were less active than expected and continued meeting face-to-face. Participants from Mekele, mostly students were less communicative due to connectivity problems. Participants from Bahr Dar and Gondar have dropped out earlier due to connectivity problems. On the other hand, new participants from Admas (previously known as Nazareth) and Addis Ababa were more active than other participants from Ethiopia.

4.5 Findings and Concluding Remarks

The action research based case study, with these three cycles, has traversed through different phases assessing various problems that were critical success factors to eLearning in the context of DCs. The findings from the first case study that was focussing

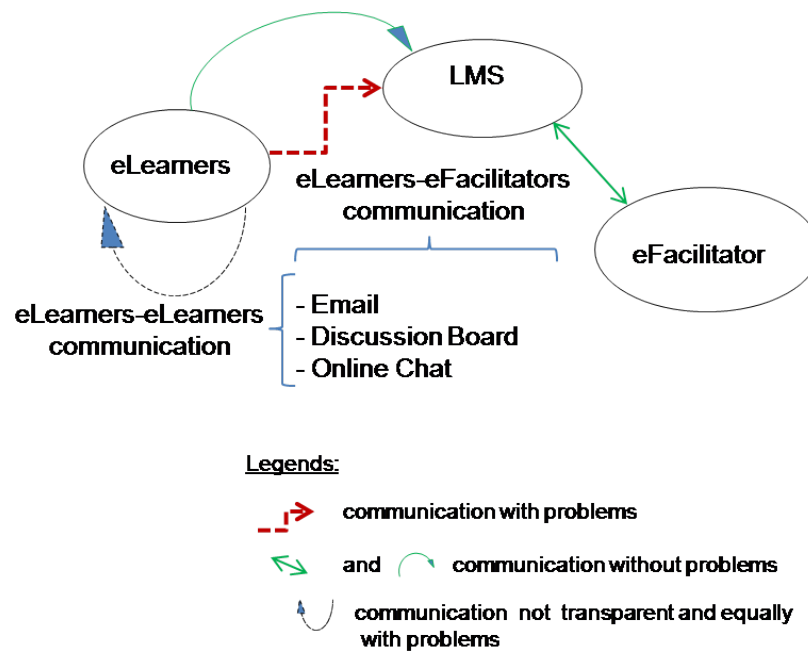


Figure 4.11: Findings form Case Study II

on the eLearning technological infrastructure, showed that ISE or eLearners were also vital to, at least assess TU. Furthermore, both the first and second cycles indicated that problems of eLearning should not be seen from the point of one segment, i.e. mono-cultural settings, as eLearning may be also part of the global knowledge system. Therefore, it was found to broaden the scope and commence on assessing eLearning in cross cultural, from the Afro-European contexts. This has been realised with the objective of assessing group-based eLearning within a different setting. This had, however, problems mainly underlining on setback from communication-interactions, exchange of feedback, since information on individuals' learning environment were scanty.

Summary of the major problems revealed and reflected by online learners during the third case study were provided below.

- This course was a wonderful learning experience. Though interaction and communication was difficult, I liked group-based online learning (from Kenya, Group leader)
- I cannot understand the problems with my group mates. It was advisable that

participants shall in the first two weeks introduce themselves and their connectivity problems, those who failed to do so, shall be regrouped so that those actives can pursue with less problems.(from Germany, Group leader)

- Even if the participant didn't have the same background that was ok and our group was very nice and interactive in each homework (from Ethiopia Addis Ababa Group leader)
- I prefer to submit assignments on individual basis, since my group mates neither respond to Emails nor participate. I even do not know their problems. (Group leader, from Mekele Ethiopia)

Various problems were raised, pertinent to group online learning. Of course, as the scope widens and the investigation deepens, new problems were arising. Learned experience from the third case study in particular and from the overall three case studies were not only getting feedback from the eLearning environment, i.e. the TA, and only the TU or ISE, but problems were capturing feedback as a repository which would assist life long learning, better eFacilitation and effective group-based cross cultural online learning.

Therefore another case study (the fourth cycle) was found necessary to assess use of ePortfolio as repository of reflective feedback.

Chapter 5

Case Study - IV

5.1 Background

Learned experiences from the previous three case studies revealed the importance of feedback about the eLearning environment and the critical success factors, namely, access to eLearning technological infrastructure (TA) and use (TU), Internet self-efficacy (ISE) and group-based eLearning (G-eL). Without basic information on these critical success factors, it was found difficult to effectively facilitate the activities of the eLearners with heterogeneous cultural background possessing greatly varying technological infrastructure required for eLearning.

Effort made to continuously and flexibly collect various feedbacks from defined critical success factors through various data collection methods had indicated that it was possible to a certain extent to fetch feedback. Problems were, however, to:

- persistently capture and store reflective feedback,
- make transparent and publicize (publish) vital information, particularly the heterogeneity of access to eLearning technological infrastructure eLearners have,
- collect reflective feedback from every eLearner, that may be not only used for a single course, but also, beyond, for life long and life wide learning.

In order to persistently store reflective feedback from every eLearner and publish selected vital information that were vital for group-based eLearning and for effective

eFacilitating, a student ePortfolio was found to be suitable. ePortfolio has been growingly used, since the past few years [137] in eLearning environments in various higher learning institutions, particularly in the USA, UK and Australia. As it was discussed in chapter 2, an ePortfolio provides several features to capture reflective feedback.

It was therefore envisage launching a fourth case study - focussed on collecting, processing and presenting feedback using an ePortfolio. hence, this part of the case study tried to present the use of ePortfolio to capture reflective feedback from participants, especially from eLearners. To realise this, effort was made to design and develop a prototype ePortfolio.

5.1.1 Prototype ePortfolio Design and Development

To materialise use of ePortfolio as a repository of reflective feedback, it was at first necessary to look for an ePortfolio that suites the requirements to use in this case study. Hence two tasks were done: firstly to look for existing ePortfolio tools and a platform that fits the defined artefacts and the objective of the ePortfolio use for this particular case study; and secondly to develop a prototype, define its goal and the artefacts that were required to capture the required reflective feedback. The second alternative was chosen to serve the purpose of this case study.

The main objective of the prototype ePortfolio was to collect, process, store and publish eLearners' reflective feedback about their eLearning environment and eLearning process. The prototype ePortfolio was proposed to store feedback collected and processed from the eLearners, such as their technology access and use, information on self-efficacy to Internet use and their expectations and experiences from group-based online learning. Coupled with this, personal profile (personalisation) and components to store the output (final output) reflective feedback were basic requirements to be added. The reflective feedback consisted of own learning (internal source of feedback), experiences and feedback collected (external sources of feedback).

The next task was to decide on either looking for an existing suitable ePortfolio to reuse with less or without customisation outlays or to design a prototype ePortfolio that specifically serve the objective of the case study. Referring back to the models, types and practice in ePortfolio use in chapter 2, there were numerous ePortfolios under use in various settings by different institutions for varying objectives. Every ePortfolio

has been designed and implemented with a specific goal to fulfil the requirements in that context. Moreover, it was also hardly possible to find and use an ePortfolio developed for a general purpose, or easily customisable with limited resources and within a short period of time to suite the needs this study has foreseen. Therefore, it was found necessary to design this demonstrative prototype.

In a nutshell, it was decided to design and develop a demonstrative prototype ePortfolio to solely fulfil specific objectives of this case study. Besides, effort was also made to carefully design the demonstrative prototype in view of further improvement, development and test it in real life projects, at later times. Thus, in order to ensure quality and validity of the artefacts and the prototype ePortfolio experts' opinion had been included, which will be discussed later in this section. Finally, after reviewing and adding gathered opinions, a prototype ePortfolio was developed and tested in the fourth cycle of the case study. Highlight to artefacts identification, experts' opinion and development of the prototype ePortfolio were provided.

5.1.1.1 Artefacts

The identification of artefacts for the proposed demonstrative ePortfolio evolved out of the practice in the previous three case studies. Artefacts were part of the critical success factors that were also associated with the basic actors and their network of eLearning discussed in chapter 2 and chapter 3.

Thus, it has been cautiously attempted to incorporate some basic features of the identified artefacts (elements) of the technological infrastructure. This was in fact a way to conform usefulness of identifying these artefacts and designing a model.

Each of the artefacts was a dossier where information (associated attributes) was processed and stored. Conceptual design of the demonstrative ePortfolio was devised in such a way that it should be quite simple for eLearners to use. Experts warned that with complexity of ePortfolio skill and time required in using it effectively may pose questions why eLearners shall do all these in addition to online learning which may be planned parallel to their other job. Barrett [137] added, that ePortfolio should be a tool for reflective feedback not a fancy of multimedia jungle. Hence, the demonstrative prototype ePortfolio was sought to be a collection of simple files processed with eLearners' preferred text processing system and attached to each artefact. The demonstrative prototype ePortfolio contained the following artefacts:

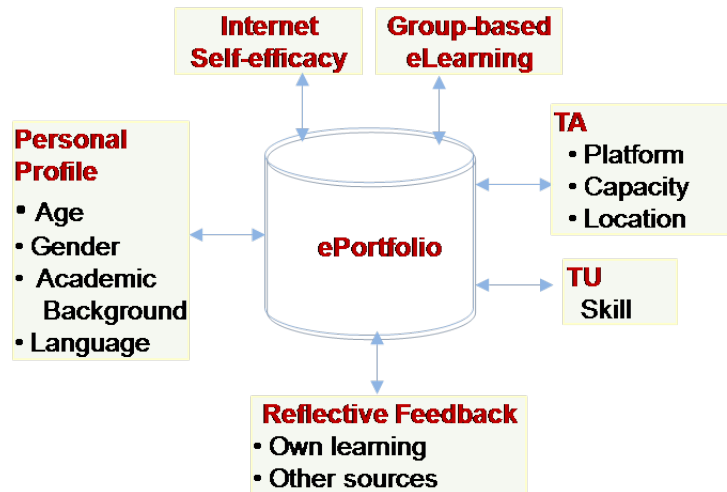


Figure 5.1: Components of Prototype ePortfolio

- **Personal Profile:** This is to comply with the standards such as Open Source Portfolio (OSP) and the IMS ePortfolio standards and also to personalize the ePortfolio use. Attributes are age (optional), gender, academic background and competencies in various languages. This can be extended to add other attributes, if necessary.
- **Access to eLearning technological infrastructure (TA):** Attributes this artefact are information on connectivity capacity, and location of access (as home, workplace and Internet Café).
- **Use to eLearning technological infrastructure (TU):** This comprises to basic skills required to effectively Internet. Though this artefact may be vital at the initial phase, it is also useful to trace and to evaluate own skill development particularly towards Internet use.
- **Internet Self-efficacy (ISE):** Alongside with TU, the artefact self-efficacy to Internet use for eLearning, i.e. one's perceived knowledge to effective use and attain online learning is also vital.
- **Group-based eLearning (G-eL):** If the objective is to facilitate a group-based or collaborative online learning, to add an artefact that continuously collects perceptions towards and experiences in group-learning is important.

- **Reflective Feedback:** This is an artefact to collect reflections on self-paced eLearning process, eLearning environment use and challenges, experiences, support services, etc. Besides reflections could be also collected from different sources, say, comments from peer and eFacilitators.

5.1.1.2 Demonstrative Prototype ePortfolio

The demonstrative prototype ePortfolio is designed based on the objective of collecting reflective feedback from the eLearning environment and eLearning process. In this case, initially, the demonstrative prototype ePortfolio has been designed for the purpose of proof of the concept on identified artefacts by experts. Thereafter, the prototype has been designed by taking experts' opinion. Finally, after setting the basic artefacts and the defining vital attributes, a simple HTML-based was developed as an interface for further use.

In general the demonstrative prototype has helped to test the objective, artefacts and attributes from the theoretical as well as from the practical point of view. As it has been discussed in chapter 2, effort is made to link between the conceptual and practical design, student ownership, simply to use, particularly without much effort to use in the environment where students are working and without any prerequisite to install, etc. In this regard, Barrett [137] briefly discussed the importance of ownership over content, such as the artifacts and reflections are basic reasons for creating the ePortfolio; and finally , for instance the sequence of activities, the evaluation criteria and the rules encompassing the design strategies.

Besides, it was also the basis to collect experts' opinion on the demonstrative prototype ePortfolio, as it is discussed below, and started introducing to eLearners who are potential users. The practical test applied during the fourth cycle of the case study was, aside the experts' opinion, where the research has also evaluated the potency while refining the artefacts and attributes.

5.1.1.3 Experts Opinion

For the proof of concepts to the identification of artefacts, we collected experts' opinion through different ways; ranging from open discussion, to workshop and paper presentation and discussion thereafter. Participants were academics, senior experts,

Experts	Invited	Responded
Managing Director of Virtual university (Prof)	1	1
ePortfolio Research and Consultants (PhD)	2	2
Senior Lecturer and ePortfolio researcher (PhD)	2	1
Lecturer and ePortfolio expert (PhD)	1	1
ePortfolio researchers (M. Edu.)	2	2
eLearning expert (PhD)	1	1
Director of ePortfolio consortium (M. Sc.)	1	1
Online Learners	7	5
Total	17	14

Table 5.1: Experts considered in the Survey

consultants, researchers managing directors and eLearners (course participants). A total of ten experts were invited to give their comment on the artefacts and attributes listed in the table. Nine of them have responded and provided their opinion on the validity of the artefacts to measure the technology access, use, self efficacy and collaborative online learning in the context of the developing countries.

Furthermore, we have also requested seven of our online learners (during the fourth case study) to give their opinion, on similar issues. 56% of them have responded. A summary table on the participation of the experts and is the questionnaire depicted herewith in Figure 5.2. Equally the summary of the questionnaire is also provided in the table Table 5.1.

Moreover, the researcher has presented content and objective of the prototype ePortfolio and it was discussed on a "Conference ePortfolio and Digital Identity 2007" organised by EIFEL¹ from 19-21 October 2007 in Maastricht. This was also a good opportunity to discuss with experts and researchers with long years experience. This concept of ePortfolio in group-based online learning in the context of developing countries has not been raised in this conference, and hence there were many participants

¹European Institute for E-Learning <http://www.eife-l.org/publications/eportfolio/proceedings2/ep2008/>

at the paper presentation and the discussion has also brought positive feedbacks. All in all, the concept as well as the artefacts brought for discussion has got a positive and encouraging feedback.

Artefacts / Attributes	Opinion / scale				
	Undecided	Strongly disagree	Disagree	Agree	Strongly agree
<ul style="list-style-type: none"> • eLearners Profile (Gender, Age, Language, Academic background, Skill and experience) • Technology Access and Use (Internet Access type: Home-based, Workplace-based, Internet cafe) and (Internet Use type : Single / shared, Narrow-Broadband) • Collaborative Online Learning (Attitude towards group work and Experience from group work) • Time Management (Personal Diary) 					

Figure 5.2: Summary of Questionnaire to Experts' Opinion

The experts' opinions collected and analysed are summarized as follows:

- All of the participating experts have expressed their opinion that they strongly agree with the personal artefact and attributes identified for the prototype ePortfolio. It was only two of the experts who recommended including artefacts designed for collecting information on technology access and use as part of an eLearner profile.
- All of the experts found collecting information on technology access and use relevant, while two have argued, that it may be difficult to recurrently update information related with access, since it was rapidly changing and equally commented difficulties or recording every action with regard to information on use.
- Sixty percent of the experts underlined the difficulties of collecting reliable information on attitude of online learners towards technology use and collaborative

(group) learning on one hand and on the other subjectivity in measurement.

- Ten percent of the experts has commented that the scales used were weak to reveal the potential use of some of the attributes.

All in all, the opinions of experts were evaluated as positive, which assisted to develop the prototype ePortfolio that was used during the fourth cycle of the case study. The artefacts and their attributes were capable of capturing vital information on technological infrastructure access and use, which was important for eLearning service providers as well as peers who have no worry with access problems. Information on technology use and self-efficacy to group learning could not be necessarily exclusive problems of DCs. It could be rather applied online learners from any country, since effective technology use for eLearning and self-efficacy to group-based online learning are taken either as a hidden assumption or a less discussed or remain.

5.1.2 Development Process

The development process of ePortfolio can be seen from different view points depending on the objective of development, i.e. whether it is opted to use as a tool or process to collect information (reflective feedback, in our case) or to use ePortfolio as a product, such as credential that reveals personal development. In this regard Barrett [94] reveals creating ePortfolio from the point of view of development process as:

- Decide/Assess - determining needs, goals, audience for the presentation
- Design/Plan - determining content, sequence of the presentation
- Develop - gather and organize multimedia materials to include in the presentation
- Implement - give the presentation
- Evaluate - evaluate the presentation's effectiveness

Whereas, ePortfolio development process as product covers the following stages [138]

- Collection - save artifacts that represent the day-to-day results of teaching and learning

- Selection - review and evaluate the artifacts saved, and identify those that demonstrate achievement of specific standards or goals
- Reflection - reflect on the significance of the artifacts chosen for the portfolio in relationship to specific learning goals
- Projection (or Direction) - compare the reflections to the standards/goals and performance indicators, and set learning goals for the future
- Presentation - share the portfolio with peers and receive feedback

According to Barrett [94] advises that the process creating an ePortfolio should be kept simple by using familiar software as you get started, citing examples how her students have developed their reflective ePortfolio very creatively complete with hyperlinks to their digital artifacts, with nothing more complicated than Microsoft Word. She argued that "above all else, the electronic portfolio should showcase your achievements and your growing capabilities in using technology to support your own lifelong professional development" [94].

In line with this, the development process of ePortfolio in general and the prototype ePortfolio in particular has been highlighted. Thus, the process flow begins with the decision on the objective and strategy of the development and publishing an ePortfolio. With a clear objective of the developing ePortfolio in general and identifying vital artefacts, the design and development continues to the implementation plan, which leads to an action. Planning comprises to selecting the type of inputs, where and how to collect them; and select for processing. Implementation starts with editing selecting inputs on the one hand and inserting them into the processing tool selected a priori. Then, final output will be stored in one or different data storage, initially as on local file server and later either uploading on the LMS, as a file or sending it through Email to wished destinations.

With this, effort is made to design the process of the ePortfolio development and publishing is depicted in Figure 5.3:

5.1.3 The Prototype ePortfolio

Finally, upon testing and validating the relevance of the artefacts and associated attributes, based on the comments and opinion of experts, the development of the

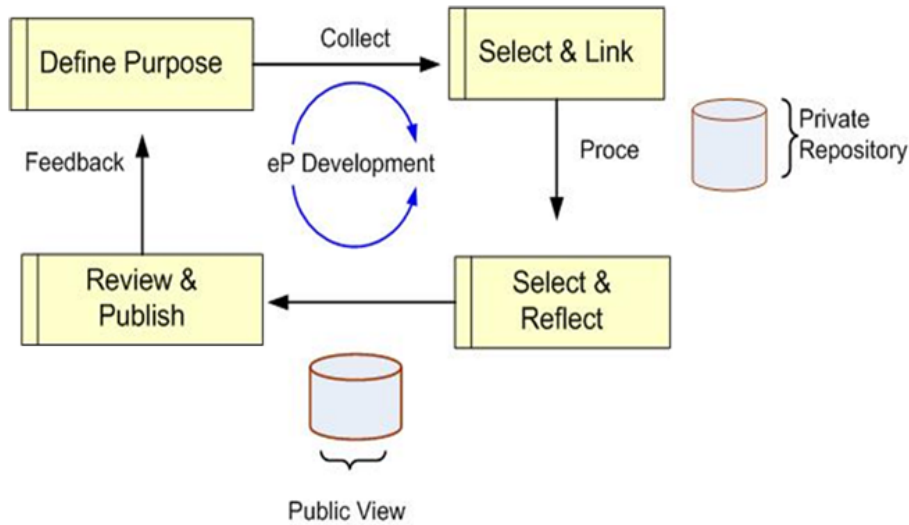


Figure 5.3: ePortfolio Development and Publishing Process

prototype ePortfolio has been finalised. In line with the envisaged strategy, i.e. use of the prototype ePortfolio to collect feedback or use it as repository for the online learning with a special focus on developing countries, we carry on modelling the basic flow of feedback using ePortfolio.

The artefacts of the prototype ePortfolio emanated from the component of the technological infrastructure, the eLearning society (profile) and educational organisation (feedback from eFacilitators). This is part of the effort to embed the ePortfolio into the eLearning which is considered as a complex network of socio-technical actors. These are part and parcel of the whole system including the feedback that is to be processed and persistently stored based on ePortfolio.

Based on the above stated development process a sample prototype ePortfolio, which we call a basic ePortfolio (BeP) has been designed and developed. Thus, the BeP is a simple HTML-based prototype ePortfolio envisaged to assist eLearners while collecting and processing their reflective feedback. Details of the development and the use instruction were attached in the appendix part of this thesis. The complete picture of relationship among various artefacts or the prototype ePortfolio-based feedback system is depicted in the Figure 5.4.

This BeP has been used by the online learners to process and present their ePortfolio. Beside the main artefacts to store vital information, some links were also added, such as a link to the LMS - to which eLearners can open the LMS from this environment.

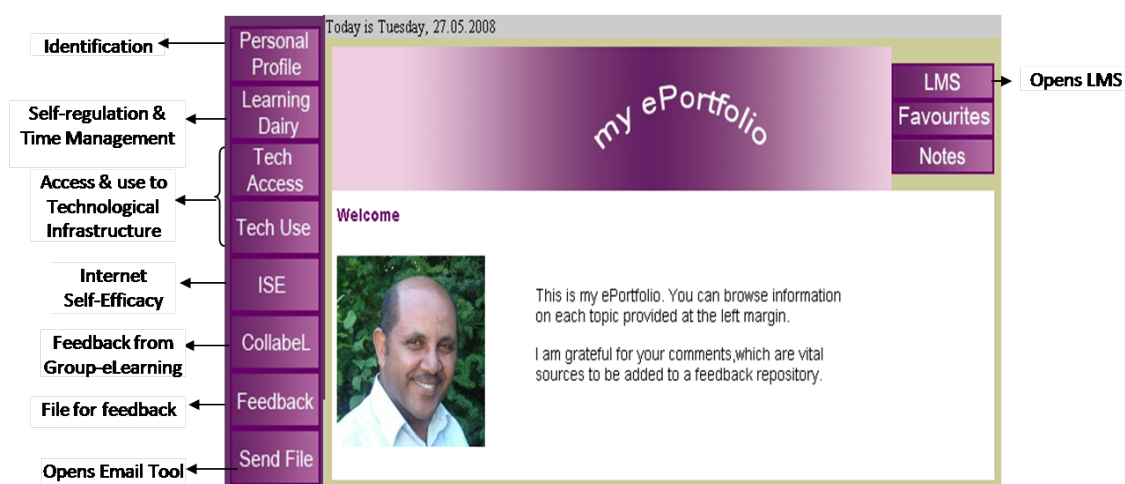


Figure 5.4: The BeP Prototype ePortfolio

Moreover, a link to Email editor was also provided.

5.2 Case Study IV: Assessing ePortfolio-based Feedback

In previous case studies, effort had been made to iteratively assess various critical success factors (CSFs) to capture feedback about the access to and use of eLearning technological infrastructure, Internet self-efficacy, and group-based eLearning. The iterative assessment and refinement guided by a series of research questions have led us to devise a mechanism to design a repository of feedback, which was ePortfolio.

The rest of this chapter reports the summary of the fourth cycle of the case study. Initially the research problem statement of this case study, i.e. the fourth research question stated in chapter 1 has been elaborated. Following that the model extended to accommodate the fourth component and the implementation and analyses has been discussed. Finally the findings and the reflections on the findings and the overall case studies has been summed up.

5.2.1 Implementation

As it was the case with other previous case studies, this part gives a summary overview of the organisation and realisation of implementation. In addition, summary of data collected using various methods has been added.

Course Selection and Setting the eLearning Environment

The course selected for the fourth case study was "Principles of Tasks and Leadership" part of a management course designed for Industrial Engineering Masters online learning program. This course was assumed to be suitable for international participants who could learn in group. MOODLE was used as a LMS.

eLearners Recruitment

The organisation of fourth case study was a partly similar to the third case study, i.e. it was online, without face-to-face session, and participants were from various countries. The recruitment had been done by openly inviting participants through posting the announcement on various Websites, including the Swedish Program for Information and Communication Technology in Developing Regions (SPIDER) which is hosted by Stockholm University, Admas College, the Association to Support eLearning and eHealthcare in DCs (ASELEH) and Oncampus hosted by the Luebeck University of Applied Sciences. Besides, invitations were also sent through Emails. With this, 103 candidates from 20 countries² had applied, while 87 were finally selected and registered.

eFacilitation and Evaluation

The eFacilitation had been done by two tutors, i.e. the researcher and the author of the course. As it had been practiced during the third case study effort has been made to arrange multiple online discussions (asynchronous as well as synchronous), of which different discussion fora, within the LMS and text-based online chat were commonly used.

Evaluations of the learning performance were designed as group assignments that were sent through Email or posted on LMS (an environment prepared for each group). There were four assignments which were designed as case studies for group eLearning. Generally, the case studies and evaluations were organised on the basis of the case

²from 5 continents

studies distributed to each group. Each group member should have participated in the group assignment, and finally a project report had been submitted.

Group Formation

For the effectiveness of envisaged group-based online learning, participants were classified into learning groups. Group members were selected on the principles of purposive sampling selection method. Therefore, care had been taken that each group should consist of members with different background coming from different countries. In general group formation was on the basis of:

- Each group contained 6-8 participants
- Each group had a team coordinator (leader)
- Each group managed its own communication and discussion mechanism
- Case studies would be discussed, solved and submitted by a group
- Submitting of assessment was based on group assignments (case studies) based on a priori set submitting schedule. The content of the case studies were published online and sent through Email to all participants

Thus, each group had elected a group leader mostly on volunteer basis. Duties and responsibilities of a group leader, as well as each participant were set, as it had been done in the third case study. Group leaders were coordinating their teams and motivated each team member to actively participate in discussions and solve the case studies. Besides, each group has organized its own chatting sessions. The researcher, at the same time, an eFacilitator was coordinating and supervising the overall groups.

5.2.2 Summary of Data Collected and Analysis

Similar to other previous case studies, in this case too, we have been able to regularly collect various types of information - of statistical data and qualitative information from different sources, such as the discussion fora, chat, email, log files and a prototype or basic ePortfolio. Major focus on this case study was use of ePortfolio to collect, store and publish reflective feedback.

For the sake of convenience, we classified sources of the information collection system into various categories, as it has been mentioned in chapter 3 of this thesis.

- Log files: In this category there were mainly the discussion fora, feedback and various access types to the LMS application tools.
- Emails were differently treated differently.
- Chat: Although, this time online chat has been conducted using the LMS, it was preferred to assess the information collected from the LMS separately from that of the information collected from other chat tools.
- ePortfolio: This was the major focus. During the fourth case study effort is made to collect additional, both formal and structured, feedback from eLearners.

Details of the data collection, i.e. the sources and collection methods used during the fourth cycle of the case study are summarised as follows.

1. Email

During the fourth case study, a total 946 Emails were exchanged among 72 active participants. Emails that were processed in the MOODLE LMS were automatically sent to all users unless a sender makes restrictions. The Email collected indicated that, on the average a minimum of 7 and a maximum of 53 Emails were exchanged per eLearner were exchanged. On the average, over 93 Emails exchanged per week and about 13 Emails per eLearner within 10 week or 13.3 per day have been recorded during this case study. In this regard, Emails fetched processed and mapped to the critical success factors, such as TA and TU have been assessed.

Meanwhile, 654 Emails (70%) were selected as containing relevant information to this case study. In this case over 371 Emails (57%) out of 654 had contents on problems of access, mainly those from Ethiopia, Kenya and Uganda. 401 Emails (61%) have reported on participation and communications problems. Most Emails were exchanged within eLearning group members, while intra-group communication was quite limited. Contents were short replies or request, mostly with abbreviations. Few Emails had attachments at the beginning of the course.

Therefore, the number of Emails exchanged was in total, 946. This shows that approximately, every participant has sent 12 Emails.

2. Discussion Board

In case study four, there were different discussion fora all within the MOODLE LMS. These were General Forum (213), the Feedback Forum (130), the Group Work and Assignments (110), and the Subject Matter (443), with entries provided in the bracket. All in all there were a total of 1,112 entries recorded. As it was indicated by the classification, about 40% of the entries in the discussion fora were pertaining with subject matter discussion. The feedback, which started later and quickly grew had a share of 12%. Contents of feedback were more or less with comments provided by all group members on the course, on communication and interactions, and at last about the ePortfolio.

3. Chat

Text-based online chat during the fourth case study had been exclusively using MOODLE LMS, since there were no extra plug-ins to install as well as, it was easier and accessible. There were a total of 4, 272 entries which is about 59 entries on the average per eLearner. Entries per session greatly varied mainly depending on the number of participants and duration of the chat session. Chat schedules were organised by and for individual groups as well as for general participants. Participants were ranging from a minimum of 2 to a maximum of 31.

Although, chatting was organised frequently and the number of participants was relatively high. It was also difficult to arrange chat sessions for all participants at a time due to time zone differences and relatively higher number of participants. Aside from that, less motivations and attitudes towards participating to online chat was seen as a barrier . For instance participants from USA, Pakistan, and Australia had exceptional problems to coordinate a group chat.

Effort was made to review 2,895 entries, i.e. 68% of the total entries. Most of the content written during the chat session was on schedule arrangements, problems of communication and lack of interaction with groups. Few, at a later phase, were on intercultural issues. By and large it was difficult to capture vital information from the chat session due to mainly unstructured themes of the discussion, repetitions, incomplete sentences, etc.

4. Group-Based Online Learning

The objectives of collecting data on group-based online learning were to assess the attitude, expectations, and performances (experiences) during this cycle of the case study. Efforts made in this regard were data collected on group-based online learning from various sources in various ways. These are the log-files, discussion fora. Learning in group and solving assignments within a group were difficult tasks to coordinate. Activities across groups have been seen varying. Figure 5.5 shows the group log files variation.

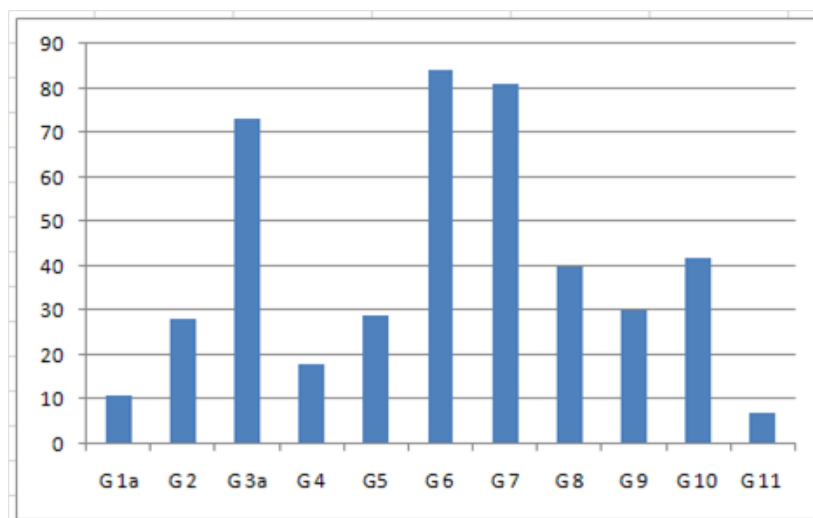


Figure 5.5: Cycle IV: Group-Based eLearning Log Files Summary

5. Log Files

During the fourth cycle of the case studies a total of 29,930 hits on the LMS system were registered. It was about 416 hits per active and 344 hits per registered participant respectively. This was by far higher record than the previous case studies. The following diagram Figure 5.6 depicted the log files on the basis of the application areas visited.

On the other hand, the log files indicated that the LMS system was visited every day and every hour of the day throughout the course durations. This was because of participants across different time zones that were accessing the LMS in different times.

Based on the collected data from the log files, the Figure 5.5 depicted, that the

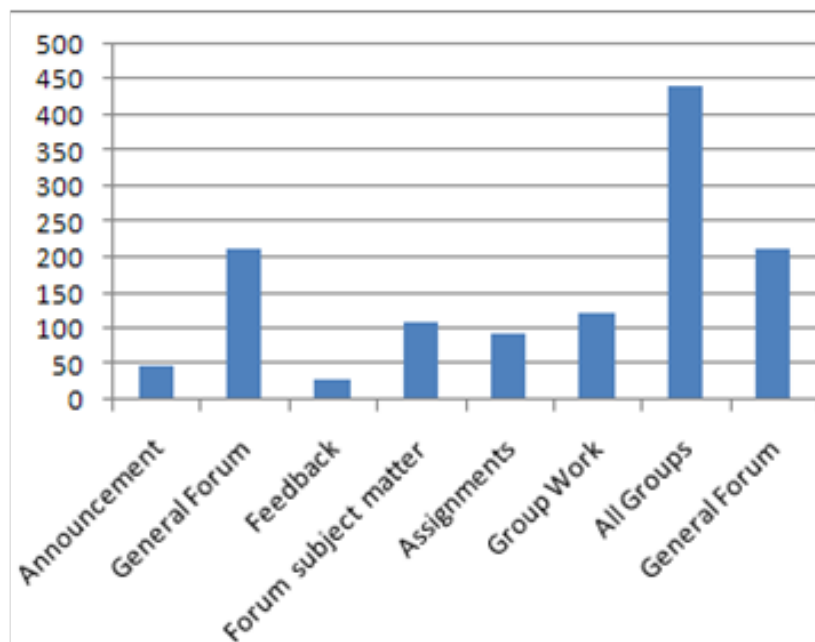


Figure 5.6: Cycle IV:Log Files Summary

variation among groups is great. Group 1a and group 11 were less active than groups 6, 7 and 3a.

6. ePortfolio - (BeP)

Using ePortfolio to collect feedback data was the feature of this case study. Effort has been made to collect data from eLearners prototype ePortfolio or the basic ePortfolio (BeP). The data collected were mainly on the number of participants who published their BeP. Accordingly, 29 eLearners out of 42 active participants³, which was 69% have published their BeP. From the total ePortfolio who used ePortfolio, 22 users have also published a summary of reflective feedback on the course, the communication and interaction, on group learning and their eLearning environment as well as their self-efficacy to Internet use. The findings are discussed and commented in the rest of the section.

³as the remaining 30 were growingly retreating from participation, we had only 42 participants who completed the course.

5.2.3 Findings and Reflections

Based on the collected and analysed data, the results from the fourth case study have been discussed on two major categories.

1. ePortfolio use and Reflective Feedback

The concept of use of the prototype ePortfolio (BeP) for capturing reflective feedback had been gradually understood and accepted to be part of the course as well as a tool to collect feedback. The reasons given were that eLearners were concerned about the extra time required and concern on technical problems such as feedback collecting, processing and publishing may require extra skill.

Gradually, eLearners started publishing their BeP and sought for feedback as well as comments. There came many positive comments mainly on personal information which otherwise were not possible to acquire. In this connection, few comments were provided herewith:

A participant from Germany has informed the peers on *Internet Self Efficacy* "I can say that I have the confidence of using the PC for learning and working purpose. I use the Internet almost everyday to check my mails and also to search for important sites where information were needed for my learning purpose".

The feedbacks collected using the BeP were impressive and useful. They revealed the eLearning environment of eLearners, their profile and positive attitude to group-based eLearning.

2. Group-based eLearning and eFacilitation

The effectiveness of group-based eLearning was dependent on the motivation of the group members and the eFacilitation, among other factors. It has been observed in both, third and fourth cycles of the case studies that where there was motivation, there was communication and interactions, despite the constraints in connectivity or other resources. If there was communication and interaction group-based eLearning as well as solving case studies or projects in group had been seen interesting and fascinating, particularly the self-regulated organisation, exchange of views and problems from different angles, etc.

The eFacilitation service for larger heterogeneous groups was found it quite challenging, while, on the other hand, it was fascinating. The challenging side

is seen when there was neither communication/interaction among groups and peers within a group nor there was sufficient information about the problems (i.e. feedback). The inspiring parts were the diversity in terms of cultural and academic background and the stimulating discussions on specific assignments within learning groups; the reflections on solutions provided by peers or other groups.

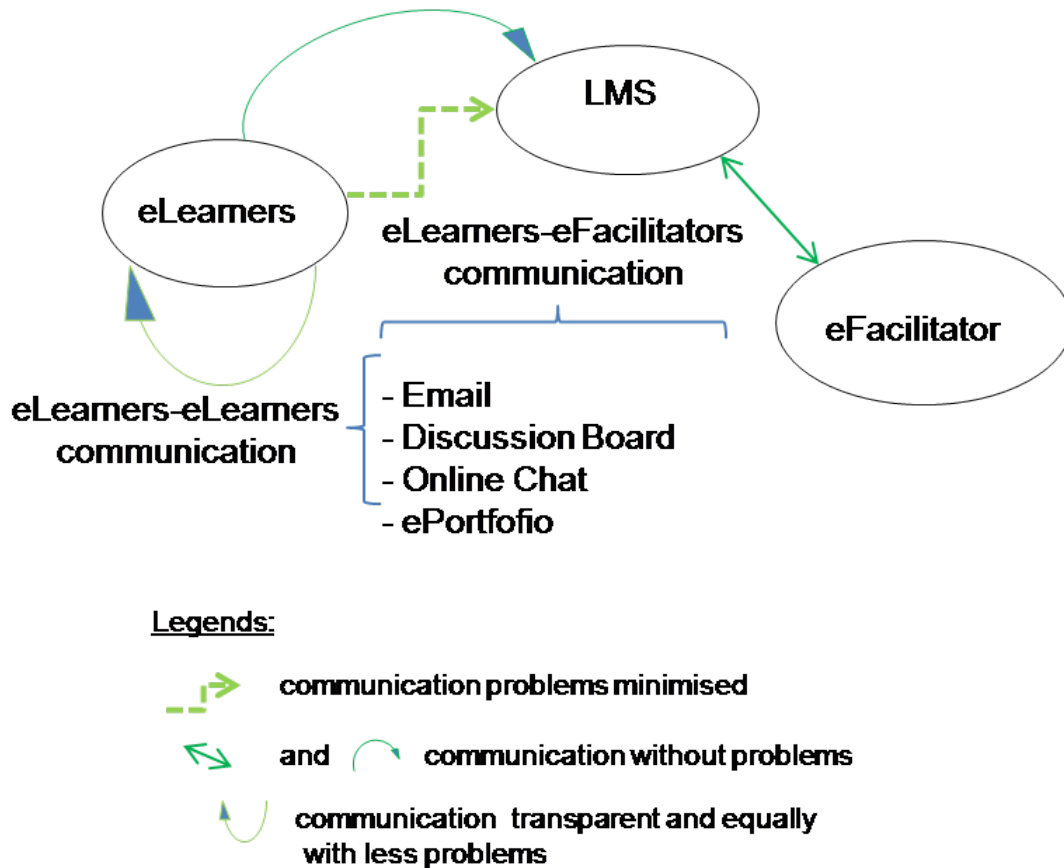


Figure 5.7: Summary of Findings from Case Study Four

5.3 Conclusion

The objective of the fourth case study was to verify if eLearners could be able to use ePortfolio to provide reflective feedback about their eLearning environment and

eLearning process and, if, as a result, group-based eLearning and eFacilitation could be improved. This was fairly attained as 69% of the eLearners were publishing their BeP and after that the discussion was focussed on reflective and participation has increased.

Moreover, eFacilitation has also been attractive as the participation and self-paced groups were doing the most part of the self-organisation. Few of the last weeks, after the eLearners started providing feedback on BeP participation and discussion within a group and intra-group has increased. Therefore, the use of ePortfolio as a repository of persistent reflective feedback to enhance effective group-based eLearning and eFacilitation could be recommended.

With this, this chapter concludes by summarizing the process and evolutionary and metamorphic development of the case studies as depicted in Figure 5.8. The curves shows the upward movements which were the learned experiences.

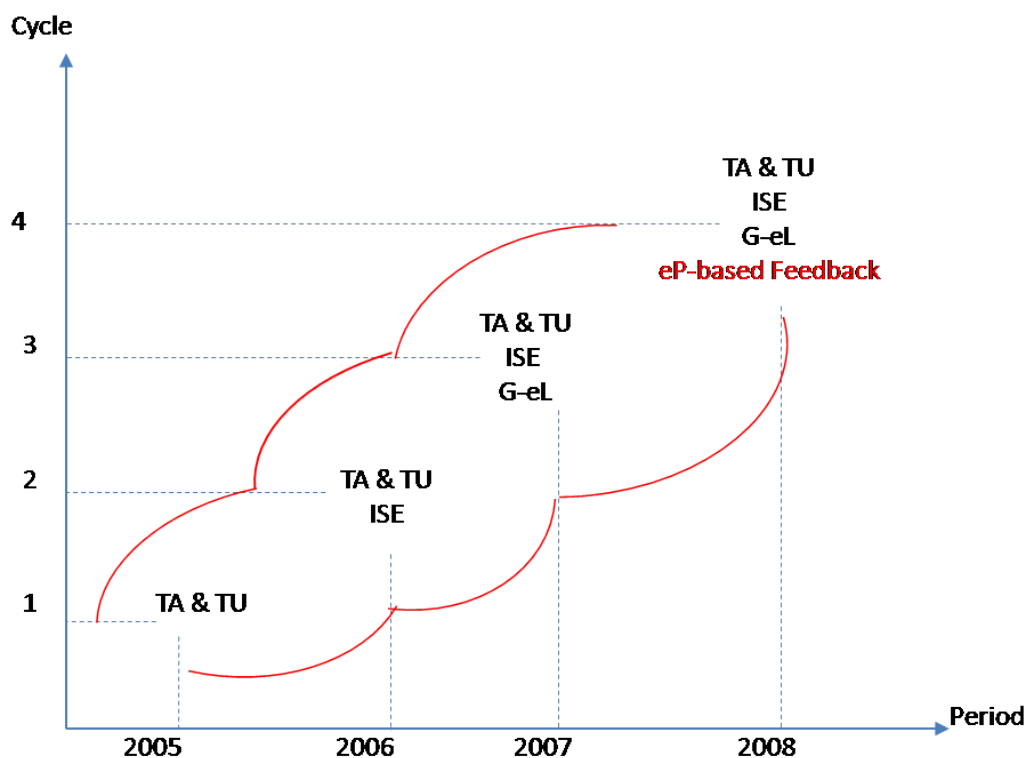


Figure 5.8: Summary of the Process and Development of the Case Studies

Details of the process of artefacts identification will be discussed in chapter 6 of this

thesis. Based on the identified artefacts, a demonstrative prototype ePortfolio, was initially developed and feedback on the validity of the artefacts as well as the validity and proof of the concept on the potent artefacts to capture reflective feedback from group-based online line learners profile and learning environment was collected from experts.

Chapter 6

ePortfolio-based Reflective Feedback Model

*"An ePortfolio without standards, goals and/or reflection is just a fancy."
Hellen Barrett, 1999*

6.1 Introduction

In the previous two chapters, i.e. chapter 4 and chapter 5, effort has been made to thoroughly discuss the implementation of four cyclic action research based case studies. These case studies have been designed and implemented based on the research framework discussed in chapter 2, and the research methodological approaches discussed in chapter 3. The major focus of the case studies were to closely assess CSF for a sustainable eLearning services development in the context of DCs.

This chapter will discuss the results of the iteratively realised case studies and findings of the overall study. As it has been discussed in previous chapters (i.e. chapter 4 and chapter 5), four cycles of case studies have been designed and realised based on the research framework (discussed in chapter 2) and the research methodological approach (discussed in chapter 3). Moreover, some selected critical success factors (CSF) required for a sustainable eLearning services development were defined and assessed in the context of DCs. Findings from the initial case study triggered further

inquiries that led to other case studies conducted in four cycles. It was observed that every stage of assessment and each of the findings were learning cycles.

The focus of this chapter is therefore highlighting and discussing the results of the case studies in particular and the overall learned experiences obtained from this research in general. Accordingly, the first section of this chapter summarized the learned experiences ranging from conceptualisation to contextualisation of eLearning in DCs; and from identifying and defining critical success factors to inductively and iteratively assessing these CSFs based on cyclic case studies. The subsequent section provided the models designed to capture the learned experiences. Finally, various models are aggregated and used to capture type of experiences attained at different levels. The aim is to give a comprehensive overview of those models used at different level of the case studies and to integrate them into the initially designed actor-network diagram chapter 3 which briefly highlights the interrelationship and individual's actor roles.

The learning cycles comprised the definition and elaboration of the initial problem statement; the designing of models and implementation of case studies, and, finally, reflect on the findings. The knowledge gained from these learning cycles constituted the learned experiences.

6.2 Reflections on Learned Experiences

"Experience plus Reflection equals Learning"
[139]

Reflections on what the researcher has traversed along with the research process and experiences are worth highlighting. The reason to start with reflections on learned experiences was to underscore the background of the research process that led to findings and results.

The reflection on learned experiences discussed in this context is a cognitive process. The experiences are knowledge gained from practical experiments by carefully and persistently grounding the findings, while the learning is the creation of meaning to the self through the development of inferences from past or current events that serves as a guide for future endeavour [140].

Towards this end, attempt is made to summarise the reflections on learned experiences

into two sections. The first section briefly highlights the learning cycles. This part deals mainly with the conceptualisation and contextualising of eLearning and the flows process of the research, i.e. from general to particular. The second part summarizes and reflects on the main findings.

6.2.1 Contextualisation and Inductive Analysis

This thesis started with a general inquiry about eLearning and the impact of technological infrastructure required for eLearning in the context of DCs. With this broader inquiry, a series of questions were raised and each question was inductively analysed. In this context Ratcliff [141] stated, that inductive analysis involved reasoning, allowing for modification of concepts and relationships between concepts throughout the process research.

The overall contextualization of eLearning and the inductive analysis was summed up with the graphical diagram as depicted in Figure 6.1.

Towards this end, the Figure 6.1 summarises the multifaceted processes depicted as a set of enquiries or specific research questions and various cycles actions undertaken i.e. the case studies that are realised to assess specific CSF. Each step undertaken contains of packages of processes which are the problems raised, definition and elaboration of the problems; model designed to solve the problems; the implementation of the model designed, data collection and analysis; and finally, documenting the findings and the reflections on the results.

In a nutshell, the Figure 6.1 summarises the multifaceted processes depicted as a set of enquiries or specific research questions and various cycles actions undertaken i.e. the case studies that are realised to assess specific CSF. Each step carried out contains of packages of processes which are the problems raised, defined and elaborated; model designed to solve the problems; the implementation, data collection and analysis; and finally, the findings and the reflections on the results. The enquiries and actions started from general to particular-showing an inductive analysis. The overall undertakings connote the knowledge gained. Summary of the research actions are:

- The researcher started with field studies and survey and reviewing the basic features of eLearning in general and in DCs in particular.

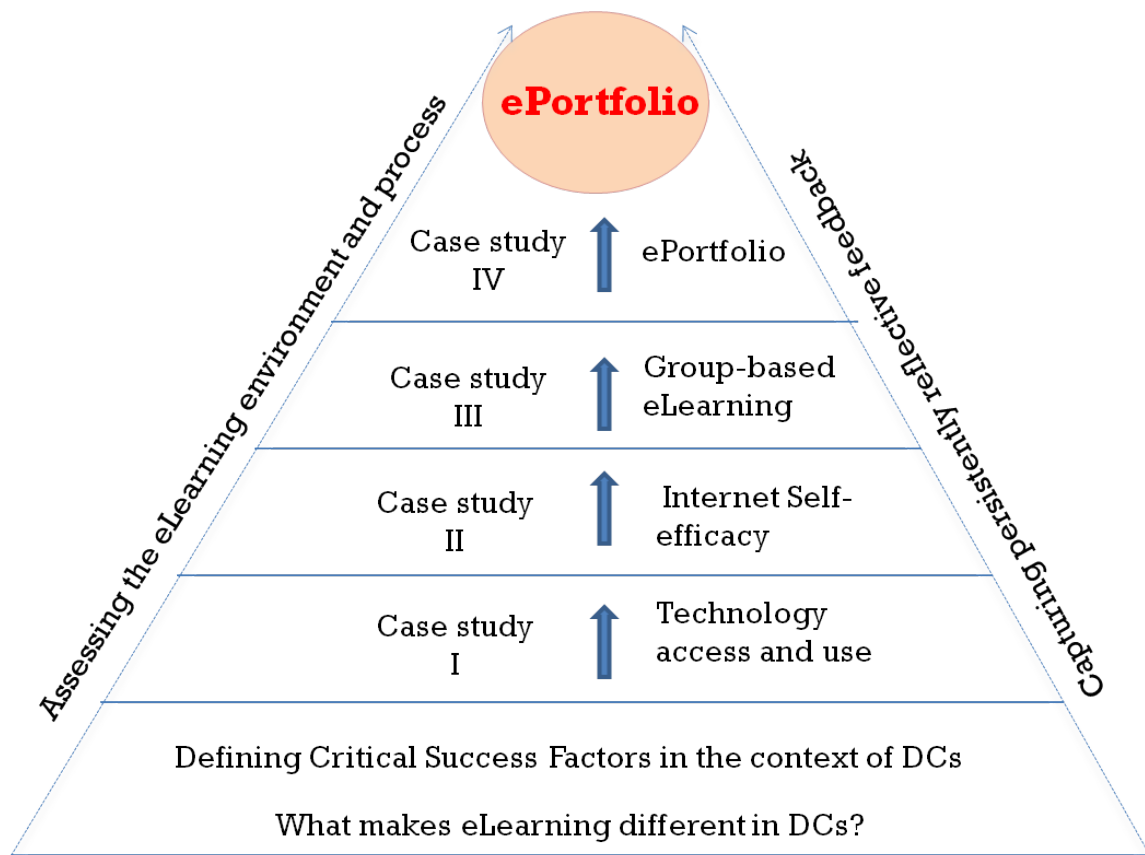


Figure 6.1: Learning Cycles

- Based on the survey it was proposed eLearning in DCs was different from that of the industrialised countries, mainly due to the differing technological infrastructure in particular and the socio-economic settings in general.
- Since both concepts of eLearning and DCs are broad enough, we again refined the inquiry to evaluate few of selected critical success factors and major in the context of a complex socio-technical network of actors.
- These CSF to eLearning in DCs, i.e the eLearning infrastructure environment and the eLearning process should be assessed and evaluated based on iteratively implemented and analysed case studies. In other words, it is needed to continuous capture feedback from the eLearning environment and process, since the change in this regard is rapid.

- Despite all of this, problems still remained unsolved were to persistently capture reflective feedback from eLearning environment and learning process to enhance social interaction and store in a repository of feedback. Therefore, it is decided to use ePortfolio to capture reflective feedback from the network of actors. Use of ePortfolio has proved to exhibit increased communication and interaction by virtue of transparent feedback on participants profile and learning environment through publishing.

6.2.2 Technology Access and Use

The background and motivation of this research were, as it has been discussed previously in chapter 1, concerns are the eLearning technological environment that pre-requisites the fulfilment of adequate infrastructure to sustainably promote eLearning services, on one hand, and on the other hand, the inadequacy (or at least the infancy) of the required infrastructure in DCs. Therefore, the thesis commenced on defining access to (TA) and use of (TU) the eLearning technological infrastructure as critical success factors for eLearning in DCs.

Therefore, throughout the whole process TA and TU have been continuously assessed and findings from each case were discussed. Therefore, based on the iteratively realised case studies, the following learned experiences from the eLearning technological infrastructure and use were problems that are summarised as follows.

- Conceptualisation of the requirements and needs for eLearning technological infrastructure access and use. The technological infrastructure is not only rapidly and continuously changing, but it is also being diversified through steady innovation, constituting the conventional communication media [142] to the-state-of-art emerging technologies. This is prevailed by absence of universally applicable standards of infrastructure for eLearning and models to specify the requirements and needs. Hence, it has become necessary to define the TA and TU so that to be able to manage the eLearning environment.
- Contextualisation of the concept eLearning technological infrastructure access and use to the local or individual needs, i.e. to the context of the DCs. Defining the access to and use of the eLearning technological infrastructure connotes

setting the meanings and contextualising the concepts within the general framework of the educational organisation, the development strategies and priorities, the global knowledge system, the socio-cultural complexes, etc. within the context of the overall actors. Therefore, this thesis, a case study in the context of DCs, has attempted to contextualise the TA and TU in particular and the overall eLearning, ePortfolio use for feedback and eFacilitation in general.

- Continuously evaluating the practices through gathering feedback from eLearning environment and eLearning process. The ubiquitous and pervasive technological innovation is at a state of continuous motion. The changes brought about have also ever increasing and deeper impacts. In line with this, effort has been made to continuously collect feedback through various means to gain up to date knowledge and thereby manage effectively the eLearning process. To accomplish this, it was necessary to design a model for the assessment as well as exchange of knowledge gained from others. The model was based on the concepts defined and context, i.e. focussed on DCs as well as connectivity specifically to eLearning purpose.

On the other side, learned experiences on access to use of eLearning technological infrastructure at a case study level were the assessment and findings on 'to what extent these critical success factors posed impacts on communication and interaction in general and group-based eLearning as well as providing feedback'. In this connection:

- During the first and the second case studies, focussed on Ethiopian higher learning context, eLearners had found more face-to-face meetings as an alternative to supplement the problems of Internet connectivity. While during the third cycle, where face-to-face meeting were not possible, eLearners had tried to flexibly look for alterative and supplementary communication media, such as use of various light weight communication tools, relying more on Email communication, and some participants in Kenya have suggested to use mobile (cell) phone and short message service (SMS) - as they were frustrated with Internet connectivity.
- Impacts of difficulties with connectivity were frustrated and gave up quickly. Six eLearners from Ethiopia outside of the metropolitan Addis Ababa (i.e. Barh Dar, Gondar and Mekele) had reported that due to Internet connectivity problems they were forced to drop out. Particularly for those who were field workers

and who were travelling to rural areas, access was a big challenge. On the other hand eLearners from Ghana and Germany were reporting their frustrations with their group mates were due to missing communication, as well as they had not even known about the problems of their group mates if they were lacking communication-connectivity or motivations. This has been reflected through discussions as "We should at least have known where the problem laid".

- What we have observed while realising the second case study was: how difficult it was to get connected, and even if one succeeded in getting the connection, how disappointingly slow it was. This could be traced from the text-based online chat, how many times participants from Ethiopia, Kenya, Uganda and Nigeria had tried and failed to get access. This had posed frustration to participants from countries that have no (or do not know these problems) connection problems, such as from Germany.
- General observation was, despite all these inhibiting factors to access the eLearning infrastructure, eLearners have acknowledged the importance of communication and interaction, at least during the third and fourth cases studies. This was explained as connectivity is improving through time, access problems might be also reduced and with the elapse of time i.e. frequent use of the eLearning environment, flexibility of eLearners, particularly when and where to access has been seen increasing.

In conclusion, the effective way to get feedback from eLearners on their TA and TU was to identify and classify the eLearning infrastructure based on bandwidth, access places, and skill. Although elements might be changing, they are also vital to determine the pattern and the system that reveals the behaviour of eLearners based on their infrastructure access and use.

6.2.3 Internet Self-Efficacy

Assessment to self-efficacy in general and the Internet self-efficacy in particular revealed eLearners outlook towards their beliefs and confidence in their capacity to use the eLearning technological infrastructure to attain formal learning goals. And this had been in socio-economic and cultural settings where this technological innovation is a recent phenomenon.

In this case, experiences showed that difficulties to access LMS or communication and interaction with peers and eFacilitator were not necessarily problems of connectivity, but the self-efficacy to Internet use (ISE), which plays one of the decisive roles. As it is discussed in chapter 2 and chapter 4 Internet self-efficacy of eLearners exemplifies their beliefs capabilities and commitment to accomplishing and fulfils challenging tasks [77] [81], such as online learning, communicating and interacting with peers and eFacilitators.

Self-efficacy has been also associated with self-assessment for eLearners on their motivations to feedback on self-efficacy. Based on our observations, eLearners with high self-efficacy were more open and motivated to new and challenging tasks.

To this end, during the first case study, three of those dropped out had given their reasons as they had no enough skill and thereby lack the confidence to be successful in an eLearning program. During the third cycle of the case study, 42% of the participants from the previous two case studies had given their reasons from failing to actively participate in the group-based international eLearning program, as "had no confidence on the connectivity to Internet". Though this was not directly related to their own capability, but it had to do with the belief they had to join the group-based eLearning. The attitude towards being ineffective was one of the factors to passiveness, according to the guided interview and workshop organised to assess the eLearning effectiveness at the end of the second case study.

This confirms to the statement of Zimmerman, Bandura and Martinez-Pons [143] which stated as "self-efficacy and personal goals at the beginning of the semester served as predictors of students' final course achievements". Moreover, the self-efficacy has positive effects on effort, persistence, and achievement [76]. Hence, assessing self-efficacy in three of the case studies was educative as well as worth classifying as one of the critical factors.

6.2.4 Group-based eLearning and eFacilitation

Learned experiences during this case study were the challenges in facilitating groups with various academic and cultural background as well as those having different capacity of access and connectivity to Internet. Besides, lack of information on the eLearning infrastructures of online learners has posed not only problems of commu-

nication and interaction as well as cooperatively solving group assignments, but also loss of motivation for group-based learning.

The learned experiences on group-based online learning during the third and fourth case studies are summarised as:

- **Group formation:** Challenges began with setting the criteria to classify learning groups. Online groups were purposively selected from various cultural and academic background and mixed based on various criteria set for evaluation, as discussed in chapter 4. However, we had experienced that some groups were left with only few participants and were not able to pursue with group-based learning. Learned from past experiences, a reshuffling measure has been undertaken during the fourth case study, as some members of two groups were frustrated due to reluctance and inactive participation of their peers to solve the group assignments.
- **eFacilitating individual groups and the whole groups together:** Individual groups were learning on self-regulated basis, i.e. they had a group leader, they can also organise their own online communication and discussion schedules as intervention of eFacilitators in many ways was needed as a member of each group. This was however, quite time consuming for the eFacilitator. Another problem was, when individual groups are communicating and interacting within their group, they quickly forgot that they were not a subset of the whole group, and hence interaction remains only within the group. This made problems of communication across groups, creating small islands of groups that posed difficulties to coordinate course participants as an integrated group.
- **Group-based assignments:** The processes of working with group-based assignments were clearly defined. Initially individuals tried the questions and send their solutions to the group leader who collected, summarised and sent to the group for discussion and comments. At last it had been sent to the eFacilitator or instructor. This has functioned well where groups members who were frequently communicating had less problems than those with communication problems. In some cases individuals who were disappointed with their group mates, mainly reluctance to communication had requested to submit their individual solutions.
- **Evaluation:** Caution required was how to evaluate individuals' contribution within a group. This triggers back to the didactics of the course organisation

and instruction design in particular and the pedagogy of online group-based evaluation systems.

All in all, group-based learning is much more dependent on the overall communication, interaction and exchange of feedback among online learners. Reflections from eLearners indicated that communication could be enhanced if everyone knows who her/his peers are. In this connection a German participant suggested that:

"Everyone who failed to introduce herself / himself should be allocated in separate group. Participants may shy off if either they have technical problems or don't want to participate any more. These participants pull back group work."

On the other hand a participant from Kenya has stated his positive experience as:

"Some of us were finding it difficult to access the internet for this course. Nonetheless, I believe that it has brought to all of us some experience we did not previously have."

To this end, group-based online learning opened a new perspective to study the communication-interaction and feedback on the eLearning environment. Besides, eFacilitation for group-based, cross-cultural participants required special soft-skills.

6.2.5 ePortfolio use for Reflective Feedback

The fourth case study introduced ePortfolio use as a repository to capture reflective feedback, as it has been discussed in chapter 5. Our experience with the use of basic ePortfolio was that it has triggered motivation towards communication, interaction and providing feedback. But it has taken some time to convince eLearners about the importance of the use of ePortfolio as a reflective feedback. eLearners were hesitant to the last minute to use ePortfolio and they had reasoned out the use, ownership, time required, sophistications of tools and skill required. But as they saw it, how simple it was designed and that the collection has a private and public component that will be selected based on the audience, i.e. who shall see the feedback.

In sum, what we have learned were:

- eLearners ePortfolio should be designed for specific purpose and should be simple to use.

- eLearners were providing feedback to peers and also collecting summarizing and publishing collected feedback. This has opened discussion, which was one of the goals to attain.

To this end, some of the reflections from eLearners are summarised as follows:

- Excitement and admiration to the information that were not revealed during the course:

"I read your Feedback Resources twice. That's quite interesting; brief as well as comprehensive on all what one needs to know about you"

".. quite impressed by your profile. At the age of 22 you have already your MBA, and M.Sc. in Computer Science!"

" This course was a great experience for me. I use to work a lot with people from all over the world - but Africa was a 'blind spot' in my list, so I'm really happy to get my first insight - even if it's a very little glimpse - into your everyday life."

- Reflections on the feedback: "Your BEP showed your eLearning process. I learned a lot. Keep up".

"This is great - I particularly like your comments and feedback sections, it provides a good insight into how you experienced in this online course".

- Reflections on the BeP as a whole:

"Well prepared BeP particularly your diary!"

"I am just very much inspired by your BeP, your competency in several languages, technical skills and experience and very interesting writing style".

In a nutshell, the above extracted reflections and feedback from eLearners posted to their peers, are reflective feedback that would have been otherwise difficult to collect, had we not been using this prototype ePortfolio (BeP). With this, what we had experienced was, communication and interaction has increased as well as feedbacks were collected, processed and published.

6.3 Capturing Learned Experiences with Models

The learned experiences were partly findings based on models designed during implementation of case studies. Elements of these models could be refined, by way of including values added through experiments, and further consolidated to accommodate learned experiences.

The main objectives of capturing learned experiences with models are, firstly to sum up the overall findings and outcome of the research; and secondly, to provide the contributions of the research i.e. the models as output. In both cases, it is hoped to lay a ground for further discussion and research on the academic scene and to start with solving similar problems by practitioners.

6.3.1 Model for the eLearning Technological Infrastructure

Based on learned experiences and previous discussion, the eLearning technological infrastructure has become diversified, partly due to problems and need for flexibilities and partly because of various options available for choice. On the other hand, there are two factors that had impact on the access and use of eLearning technological infrastructure, namely the absence of universally accepted standards and specifications set by LMS vendors and the steadily changing innovation that complicated even available de facto standards.

The landscape of the eLearning technological infrastructure has three main components. These are the learning and communication platform, features of access and use, as depicted in the Figure 6.2.

The technological infrastructure identified and specified in these models are categorised into:

1. *Learning and communication platform or resources*

The LMS is mostly provided by the educational organisation or the eLearning service provider, wherein it is used as a communication and interaction media and the virtual learning room. However, based on our experience, most of the communications are undertaken through Email and indeed outside of the LMS. For instance, if an eLearner uses a Yahoo Email, it is much more likely that



Figure 6.2: Model for Technological Infrastructure and Landscape

she/he uses more often this Email tool for all communication than logging on the LMS. Similarly discussion with peers has also been chosen based on their convenience either through chat (synchronously) or discussion fora rather than rigidly sticking to the LMS which is associated solely with registration as a formal student. Thus, we should not only expect that eLearners will be dependent on the LMS for communication and interaction. This increased flexibility according to users need. For example, a German participant, who was also a regular online learner, had expressed his disappointment with the LMS. The LMS could have been customised on the basis of the requirements of online learners' mere collection of less useful tools.

2. *Technology access*

Under this category we have listed the capacity, i.e. the type of bandwidth, and the location where eLearners often access. Both elements were quite vital and need to be regularly checked. Although technology access and use may be changing continuously and rapidly, it must be taken into consideration as a matter of strategic policy to include various access capacities. Those who do not have Internet connectivity at home may not be as flexible as the others who may be available even late evening for online discussions.

Therefore, access capacity (i.e. bandwidth) and places of access or connectivity (i.e. workplace, home and/or Internet Café) that affect eLearning have been included as one component in the technological infrastructure model. This component shares elements included in the specifications of the IMS-LIP [88] such as accessibility, availability, affordability, etc.

3. *Technology Use*

As discussed previously presented eLearning technological infrastructure use was associated with the skill and ownership or affordance. Information on skill to effectively use was also considered as one of the critical success factors. On the other hand, effective technology use was dependent on ownership, i.e. degree of freedom to access anytime and anywhere. These elements are one of the CSF for eLearning in the DCs, based on the practical problems prevailed during the case studies. The use of eLearning technological infrastructure is also vital not only for effective eLearning, but also to use ePortfolio to collect, process and publish reflective feedback.

6.3.2 ePortfolio Model

The ePortfolio model was designed to capture reflective feedback from eLearning environment and eLearning process, particularly of specific critical success factors discussed. The ePortfolio model contained artefacts and attributes carefully identified and evaluated by the fourth case study. The model itself could be integrated, as a component in any platform or could be further developed to be used as an application tool.

The artefacts of the ePortfolio model are, as it has been discussed in chapter 5:

- Personal Profile
- Access to eLearning technological infrastructure (TA)
- Use to eLearning technological infrastructure (TU)
- Internet Self-efficacy (ISE)
- Group-based eLearning (G-eL)
- Reflective Feedback- a summary of collected feedback processed for public access
- Links

On the other hand, the ePortfolio model has presented each artefact as a template that could be processed separately and integrated when processing is completed. Coupled with this the ePortfolio has, a repository for all resources and a view of selected information. In other words, the ePortfolio consists of two types of repositories, i.e. a private and a public components, where the private part (component) is a master collection which is not accessible to public. The public component, on the other hand, is a view of selected information from the private repository for targeted audience or specific goal. As the name connotes, the public component can be published to be viewed or reviewed by selected people and/or institutions or general public.

6.3.3 Model for Scenario-based Feedback

This model was designed to highlight the communication and interaction among eLearning actors to enhance feedback. As it has been discussed in chapter 2, actors' interaction and feedback flow has been modelled using a sequence model, which is widely used in specifying scenarios that describe how different actors (e.g., system components, people, or organizations) interact; often used as a starting point for software analysts to discuss the behaviour of a system with different stakeholders. Hence, our feedback model is based on the message sequence charter (MSC) approach. The overall structure of the feedback model is depicted in the figure 6.4.

Having a brief look into the requirements and the objectives of the modelling feedback, effort has been made to graphically depict the flow, which shares some basic principles of the Message Sequence Chart (MSC), such as the asynchronous message transfer.

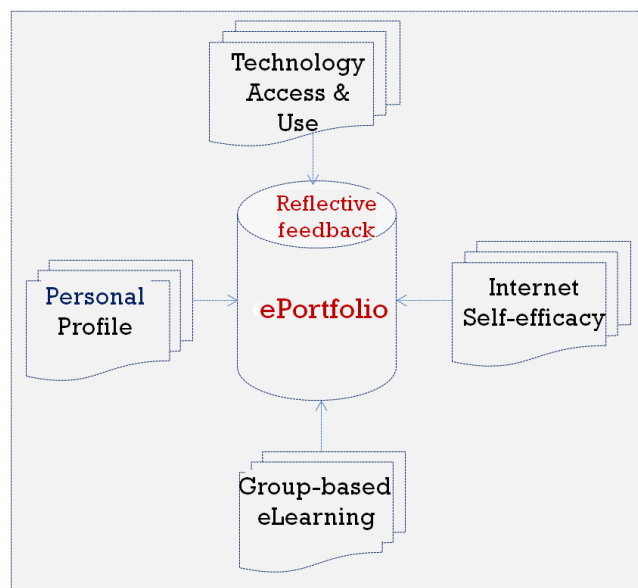


Figure 6.3: Portfolio Model

The MSC has been used in telecommunication fields for message sequencing. In the context of feedback among participating actors, scenario-based MSC reveals various options of communication flow or paths with respected participants. The objective is to highlight communication alternatives exhaustively and note on the path as well as the degree of influence of technology.

Based on the diagram Figure 6.4, the vertical pillars are indicating the process in the feedback sequence undertaken by actors namely the educational organisation (left side) technological infrastructure or LMS (in the middle) and the eLearners or learning society (right side). At the top line is the processes associated with the actors; P(O), P(T) and P(E), denoting processes triggered by educational organisation (Facilitators), technological infrastructure (LMS), and eLearners, respectively. The horizontal lines represent the path or connectors which transfers feedback message from one node to the other.

For the sake of better clarification of the features of the feedback model, we have briefly discussed the prevailing situation and conditions and classified the various possibilities (scenarios) of feedback flow and time intervals. The feedback model is a scenario-based model that are classified as:

1. **Prevailing situation (Conditions)**

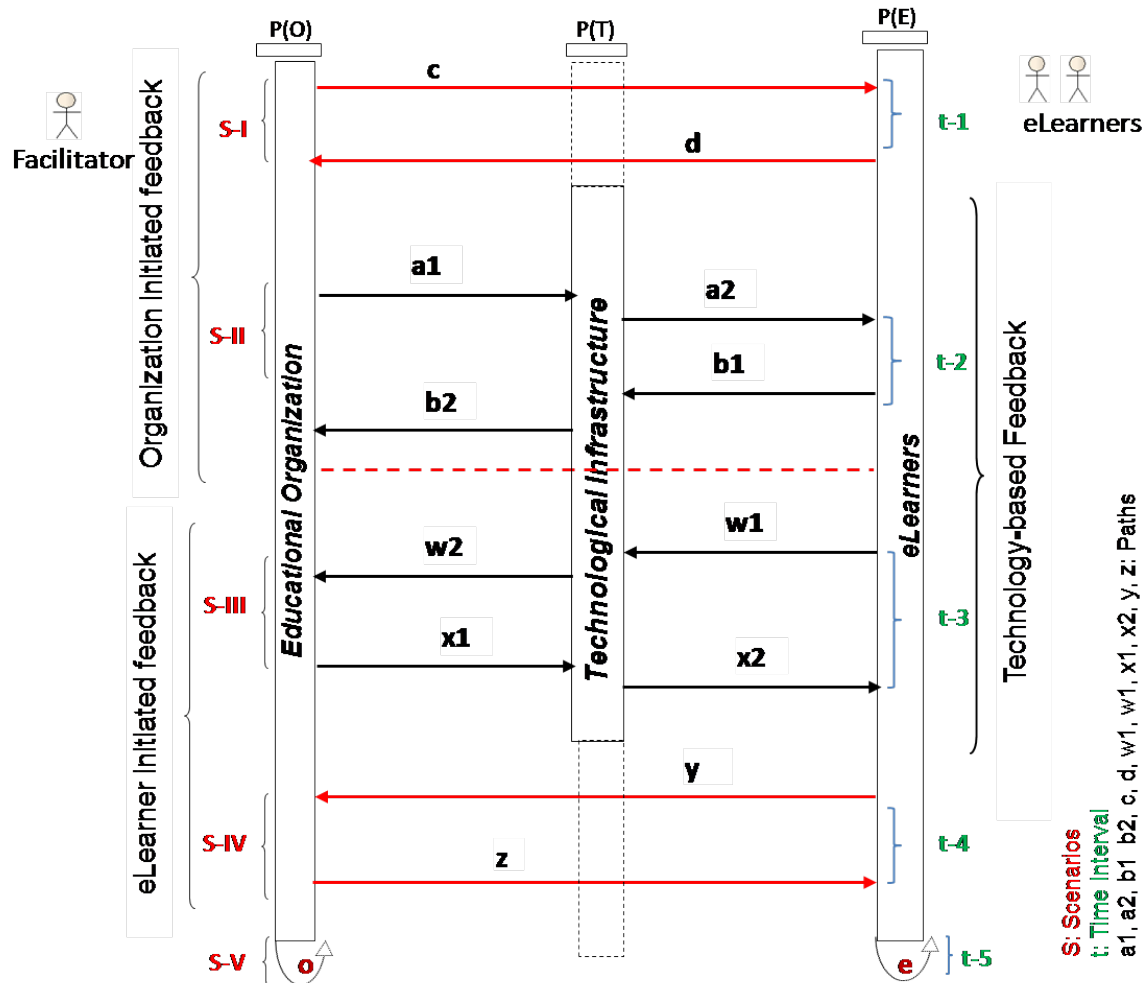


Figure 6.4: Feedback Model based on MSC

- Feedback is initiated (initial request) by either a facilitator (request for feedback from eLearners) or eLearner (request for feedback from eFacilitators, peers and group-mates). This is shown by a uni-directed horizontal line. eFacilitators initiated feedback is drawn from left to right, while eLearners initiated feedback is drawn from right to left in accordance to the place these actors are placed with.
- Feedback or message exchange is done either through Email or using the LMS (learning platform). It may be also both ways, so that eLearners with connectivity problems could have alternatives. Each Email communication

is assumed to be undertaken without using the LMS.

Besides, there are five scenarios (S-I to S-V) with respective time-intervals. Time intervals are not guarded (in this particular case). The duration of request sending/receiving, processing and responding/receiving are left open to be decided case-by-case, since it depends on several factors.

2. Processes and procedures in MSC-Based Scenarios

- **eFacilitator Initiated Scenario (S-I):** An eFacilitator (PO) sends a request message (path "c") to eLearners (PE) through Email. eLearners receive this request message and are expected to respond back to the requester (path "d"). The time interval required for processing this feedback is "t-1" - a total of time required for the feedback loop based on this scenario.
- **eFacilitator Initiated-Technology enhanced Scenario (S-II):** An eFacilitator sends a request message (path "a1") to eLearners using the LMS i.e. uploads or writes on the feedback request file directory. eLearners, who are assumed to visit the LMS will fetch the request and process the response (path "a2"). Finally they enter their response on the LMS (respective file server). This is path "b1". Similarly, eFacilitators who visit the LMS will collect the response (path "b"). Respective time intervals are also designated as "t-2".
- **eLearner Initiated-Technology enhanced Scenario (S-III):** Similar to S-II, except that it is eLearner initiated and hence the direction of the paths flow from right to left. The paths are, "w1" and "w2" and "x1" and "x2" for request and response respectively; with time interval "t-3".
- **eLearner Initiated Scenario (S-IV):** Analogous to S-I, this scenario is eLearner initiated feedback without using the LMS, due to connectivity problems to access the LMS. Therefore each eLearner sends feedback request to the eFacilitator, peers and/or group mates through Email (path "y"). Path "z" denotes the response sent back. "t-4" is the sum total of the time interval.
- **Communication and Interaction within a Single Actor Scenario (S-V):** This scenario reveals the intra-actors communication (without the

participation or moderation of the eFacilitator) and interaction as well as exchange of feedback. In short this is a scenario for interaction among eLearners with eLearners and among departments (units) of educational organisation. On the other hand, however, this, scenario is quite open for both modes of feedback either through Email or using LMS. Paths, plotted as semi-circle are "o" and "e" for feedback flow within educational organisation and eLearners, respectively.

At last, it is also assumed that certain conditions shall be fulfilled. Such as:

- Participants (both eFacilitators and eLearners) shall have access to Internet irrespective of the bandwidth. It is however expected to possess minimum skill to use Internet, particularly use of Email
- eLearners and eFacilitators should be willing and able to communicate and interact (irrespective of the frequency and mode of communication) with other participants as well as providing requested feedback including personal profile as well as information on technology access and use

By-and-large, this feedback model threw light on the feedback sequence and also it showed how actors interact within a defined network of the actors. With the MSC principles based feedback model, we have also tried to highlight the asynchronous communication among actors where timing will be visible and followed up. Therefore, this could also serve as a communication scenario for the network of actors.

Beyond the harmonious actor-network co-existence and balanced power principles, we have also shown, with this compact MSC-based feedback flow that the mediatory and intermediary role of actors, where, based on the available resources and effective, alternatives could be also managed leaving the inaccessible aside. This has been vividly shown with or without the technology-coordinated or mediated feedback. With this, effort has been made to understand how the interaction and feedback in online learning functions.

For instance, in case of the paths (feedback process) c, d, y, z, o, and e the role of the coordinating actor is either limited or non-existent. This showed that, according to this model technologically deprived participants, in which access was limited. This calls upon looking into alternative and/or supplementary ways.

Furthermore, feedback initiated by the education organisation or the eLearners would hint whether the pedagogical system is designed as eLearners centred (x_1 , x_2 , w_1 , w_2) or organisation enhanced (a_1 , a_2 , b_1 , b_2).

To sum up, the overall scenario-based communication model depicted on diagram 6.4 can be summarised as communication and interaction using or without using the LMS as shown in diagrams 6.5 and 6.6. The previous diagram represents the MSC-based Feedback flow model in the case of weak technological infrastructure. This connoted that, most of the time accessing the LMS required better Internet connectivity, the communication among actors, i.e. online learners (among their peers too) and eFacilitator with other Instant message tools, without the use of the LMS. This is what had been often experienced in our case study.

In another scene, it could be noted that the experiences gained by researcher, during the last four years, while he was working as an eFacilitator to regular M.Sc. and B. Sc. eLearning courses at the Luebeck University of Applied Sciences, have provided him ample opportunities to learn from diversified situations. almost all participants were from Northern Europe, where connectivity problem was not a matter of concern. In this case, however, eLearners were seldom visiting the LMS for several reasons. Therefore, though the LMS is the official virtual learning room that shall be also a communication and interaction platform, online learners and eFacilitators may not necessarily solely limit their communication and interaction to the LMS, but may use communicate platform or tools outside of LMS. Meanwhile, eLearners may selectively and indeed reservedly use the LMS.

Summary of the Scenarios in Accessing the LMS

Based on the experiences gained during realising the case studies, there were two scenarios of communication and interaction between the eFacilitator and the eLearners.

- Communication and interaction without using the LMS, as depicted in Figure 6.5. This was often practiced. In this scenario, the communication was mainly through Emails. There were other possibilities such as use of one or several of the social networking tools, though it was not applied in neither of the case studies, simply to avoid complications. Most eLearners, regardless of the connectivity problems have used this scenario.
- Communication and interaction using the LMS, as depicted in Figure 6.6. This was seldom practiced, particularly for those who had problems of connectivity,

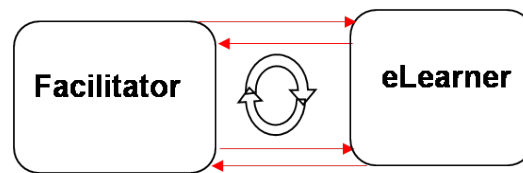


Figure 6.5: Feedback without LMS

but not exclusively. In this scenario, the discussion board embedded in the LMS was used, but the Email tool was not used. This scenario was practiced more during the fourth case study.

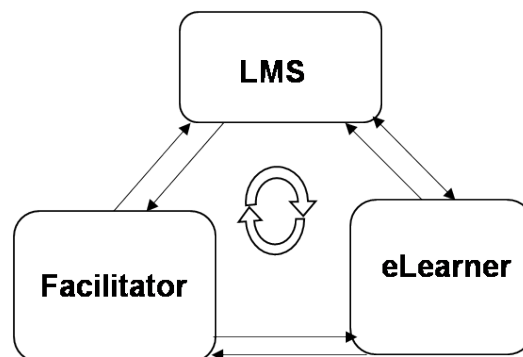


Figure 6.6: Feedback with LMS

6.3.4 Aggregate Model for ePortfolio-based feedback

6.3.4.1 The Aggregate Model

The aggregate model, depicted in Figure 6.7, was designed by combining three of the models discussed in this chapter. The main objective was to combine the overall effort made. On the other hand, with this aggregate model, it has become plausible how the role of eLearning actors in the network of actors had been defined. This backtracked to the initial model designed to highlight the critical success factors within the network of actors.

Further descriptions of the flow of feedback, i.e. interaction in graphical representation of the model, are as follows.

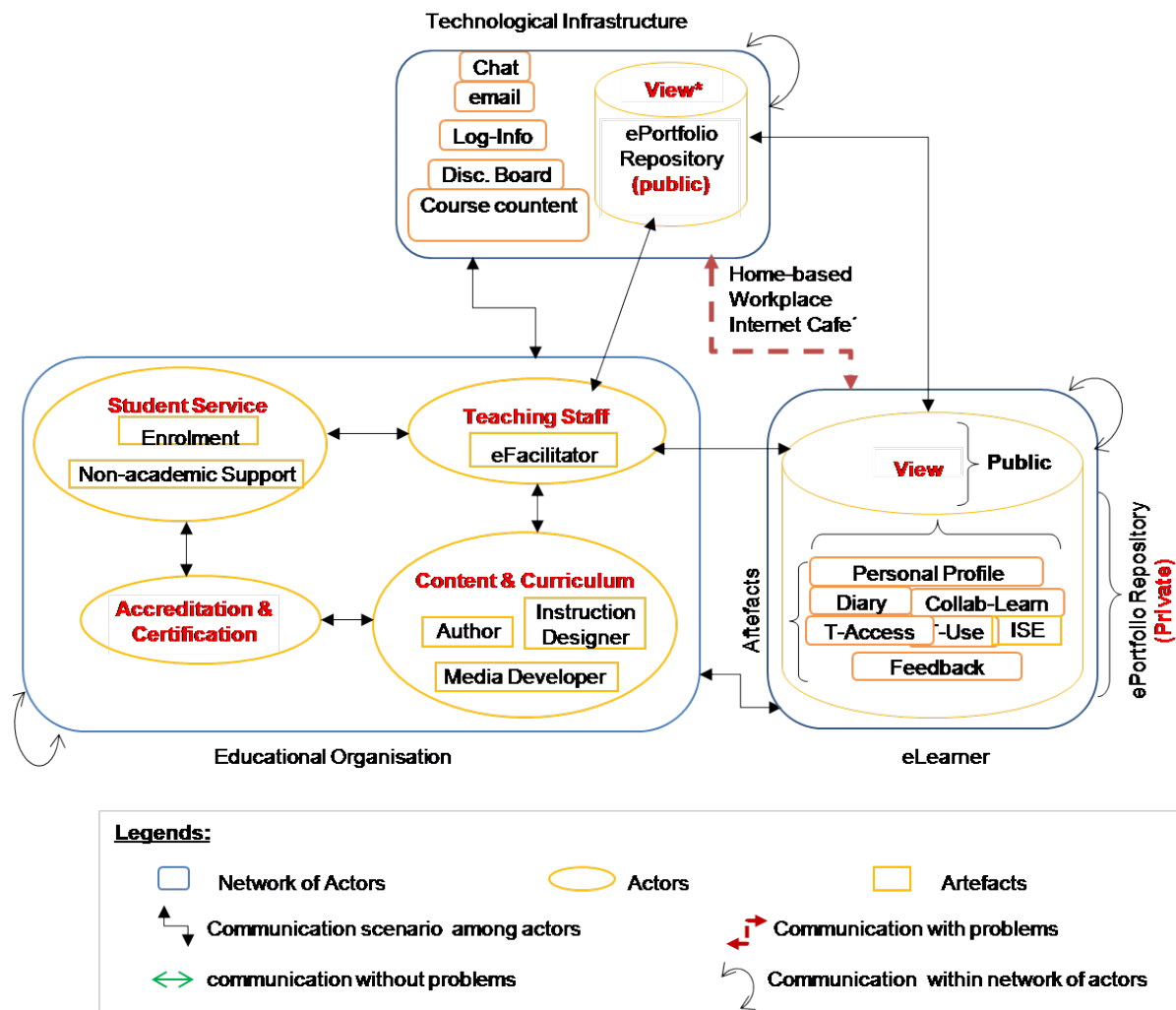


Figure 6.7: ePortfolio-based Feedback

1. Actors could be a single one or a network of various actors, where these actors might have been also emanated from a networks of actors.
2. Three of the network of actors connected by the zigzag arrow, where eLearners may have constraints in some cases to access the LMS. The connection with dotted zigzag arrow, as depicted in Figure 6.7 indicates the connectivity constraints, i.e. communication and interaction between the network of actors (in this case between the eLearners and the technological infrastructure) is limited.

3. Actors within the network of actors were connected with a bidirectional straight arrow, showing that they can access as well as download information. It is also assumed that there are communication and interaction within actors of given at the network.
4. In this model, as it was depicted on the right bottom of the Figure 6.7, it was assumed that ePortfolio is prepared (collected, processed and published) by eLearners. Furthermore, ePortfolio is classified into two categories, namely the public and private repository. While public repository was selectively published (output) or final product, private is a complete collection or resource owned and stored by the maintainers (i.e. in this case, eLearners) at their total disposal. This distinction motivates maintainers, to collect and process as many information as they can. The public can be uploaded on the LMS or sent to peers and/or eFacilitator. Artefacts that shall be included in the ePortfolio are also enlisted in the diagram.
5. The LMS was a platform where several tools were integrated, such as chat, discussion forum, all log files (statistical information), the course content, Email and more other similar tools, as it is shown in the left bottom side of the Figure 6.7. Moreover, the LMS is a communication and interaction platform considered as a virtual learning room. In our case, the BeP (the basic ePortfolio, i.e. the prototype) is also integrated (at this stage as a collection of files) as a component to store eLearners BeP, i.e. the public view. This will be accessed by actors in the educational organisation, directly.
6. Actors within the educational organisation constitute a network of actors. This connotes that according to the ANT, an actor can have one or more actors, whose network can make up one actor. This is that advantage of using ANT to design a chain of network of actors, where an actor can also consist of a network of actors within its domain. Four major actors that consist of a network of actors are included in the educational organisation actor, as provided on the upper side of Figure 6.7. These are:
 - Teaching staff (Instructors and eFacilitator) - directly participate in the online learning and feedback process
 - Content and curriculum development - this includes authors (subject matter experts), instruction designers and multimedia elements developers

- Accreditation and certification service - Accreditation is a process in which certification of competency, authority or credibility is presented (wiki)
- Student service - Learner enrolment and Learner administration, registration (student record centre), consulting and guidance, non-academic support services, business development (financial matters)

Most important of all are the teaching staffs or specifically the eFacilitator. This actor plays a central role within the network of the educational actor as well as in the overall network of actors. This is particularly the case in group-based online learning in DCs, where the technological infrastructure may not be as accessible as in the industrialised Western world. Moreover, the role of the eFacilitator will be of immense importance in case of intercultural collaborative online learning, since the eFacilitator is a prime coordinator as well as translator (actions) in the communication and interaction as well as group in learning.

In conclusion, this model serves to facilitate reflective feedback using ePortfolio, most particularly for the group-based online learning in developing countries. This aggregated model also shows the role and functional relationship among vital actors in eLearning. Moreover, through this ePortfolio-based reflective feedback model, the networks of actors can be better optimised and hence a higher quality as well as sustainable eLearning services will be provided.

6.3.4.2 ePortfolio-based Feedback Scenarios

In practice the ePortfolio-based Feedback will be used in various ways, depending on the technology access and use and based on the defined role of network of actors in the feedback process. For instance, the following two scenarios are observed.

1. Scenario I: eLearners possessing broadband Internet connectivity publish their ePortfolio (view) on the LMS. Equally they can also access ePortfolios from other peers and fetch any feedback from the LMS.
2. Scenario II: eLearners possessing narrowband Internet connectivity and those having difficulties accessing the LMS, send their published ePortfolio (view) to

eFacilitators (educational organization) and their peers through Email. eFacilitators are responsible for further distribution (within the educational organization and publishing on the LMS). Equally they can only be communicated through email in case of sending ePortfolios from other peers.

Based on the ePortfolio-based feedback model, the sequence of the feedback flow can be schematically summarized as, a request and a response (publishing). To provide a sample how the feedback process can be specified, we have taken two cases, i.e. a request and response process as graphically provided in Figure 6.8 and Figure 6.9.

The eFacilitator-initiated Request for feedback

If an eFacilitator wants to view and review the profile (personal profile and information on technology access and use) of each eLearner, what he may do is check if eLearners have already uploaded their ePortfolio (BeP) that consists of feedback on the file directory provided on the LMS. If there is one, then the eFacilitator looks into the content of the profile so that the eFacilitator can briefly identify the online learning environment. This vital information gives clue how the online tutoring shall be designed. If there are comments to add, then the eFacilitators adds on the BeP feedback section for the respective eLearning and uploads or saves the file.

On the other hand, if there is no ePortfolio (BeP) on the LMS, then the eFacilitator will send a request to eLearners either per Email or publishes the request on the announcement section of the LMS. This is, indeed, what we were doing during our case studies (pilot project).

The eLearners' Response to a Request for feedback

If eLearners have access to the LMS, they can publish (upload) their basic ePortfolio (BeP) on the LMS. If they have difficulties to access the LMS, then they will send it to the eFacilitator and also to their peers through an Email. This is depicted as Figure 6.9.

The process of communication and interaction is not only among eLearners, but it is also among eFacilitators. The reflective feedback collected would have, however, a wider use. For instance content developer or the eLearning platform service providers may be aware of the technological infrastructure eLearners possess to access the resources. With this, content developer and LMS providers may take into consideration the realities of eLearners from technological weak areas, such as DCs, rather than

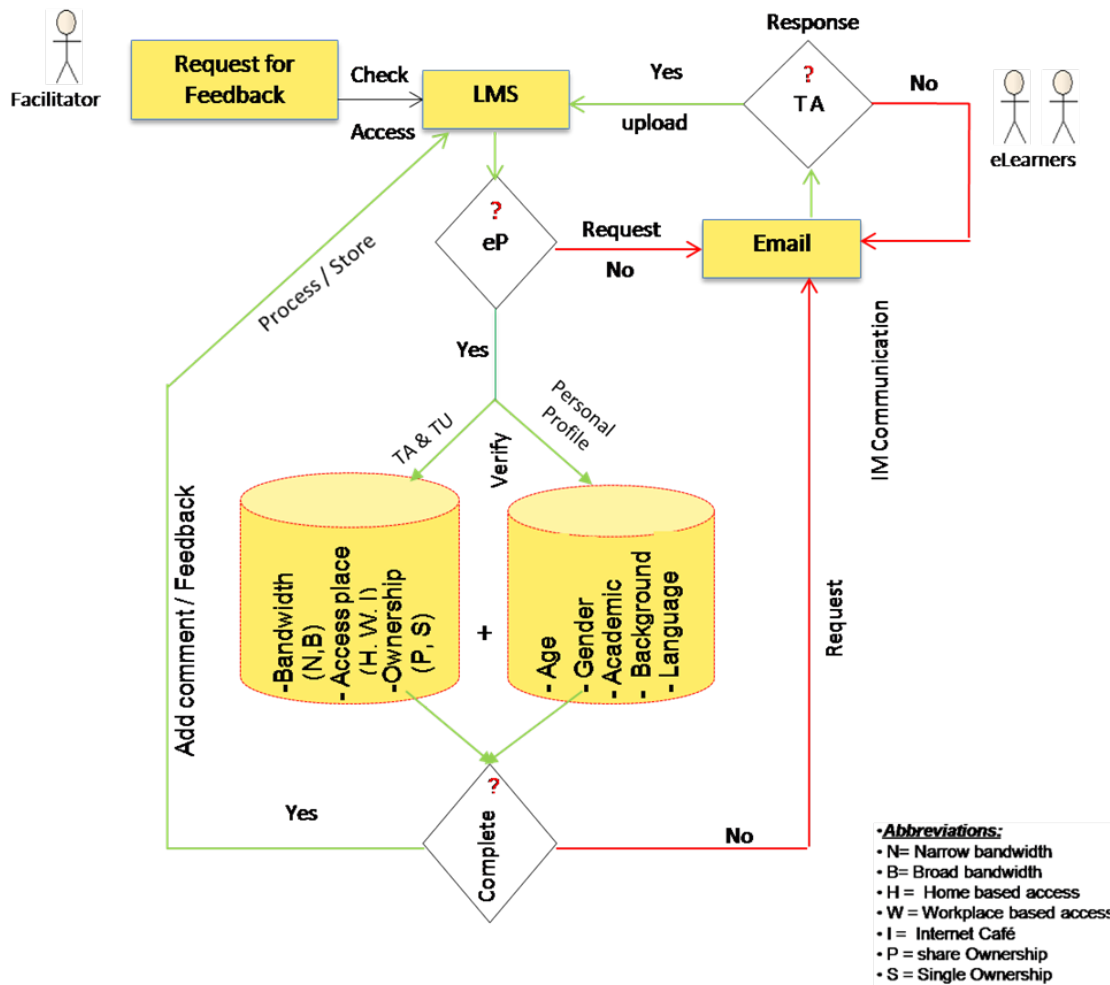


Figure 6.8: eFacilitated initiated eP-based Feedback

assuming "build it, they will use it". This has been noticed during the case studies that eLearners from Ethiopia had difficulties in, not only accessing the LMS, but downloading and opening heavy weight files.

On the other hand, use of ePortfolio assists particularly in eFacilitating. Such as, eFacilitators may know eLearners eLearning environment through the published ePortfolio, which has an artefact that indicates this resource, as it is designed and implemented during the fourth cycle of the case study. Therefore, the following process has been formulated to assist eFacilitators.

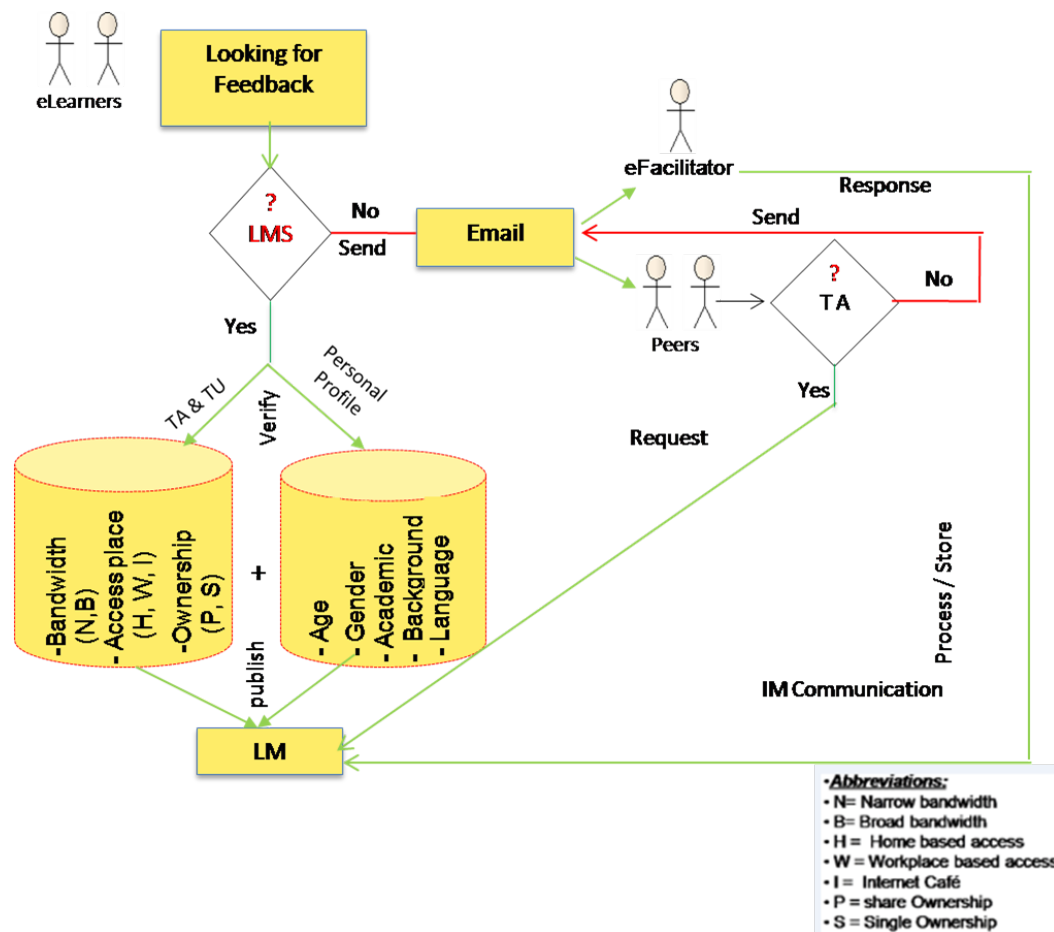


Figure 6.9: eLearners' Response to eP-based Feedback Request

- Initially, eFacilitators shall ensure technology access and use conditions (situations) of the eLearning environment before planning any facilitating activities. This is what requests participants were asked to check their browser as soon as they start accessing the LMS.
- Secondly, an eFacilitator shall request participants to edit (document) their profile and introduce themselves to their peers. This is also normally what conventionally will be done voluntarily, such as the initially greetings and self-introduction. But in this case, it must be a mandatory as well as formal. At this or even at an earlier stage, it is advisable to introduce use of ePortfolio.
- Thirdly, based on the knowledge on each and every participant learning groups will be established. This can be in any form or constellation. As almost everyone

knows who is who, this will simplify group formation as well as enhance quick start with group assignments. At this stage communication and interaction among participants (including eFacilitator) is obviously higher. However, there is also a danger that communication may be limited within the smaller learning groups. Thus, it is up to the eFacilitator to initiate inter-groups and overall participants' interaction.

- Fourthly, the eFacilitator provides reflective feedback on group as well as individual learning process (participation, strength, weakness, problems, special needs, etc.). This is quite decisive and requires special skill (soft-skill) as well as self-motivation, i.e. interest, flexibility, understanding social cyber network, cultural variations (sensitivities and limits), etc. For experienced and keen eFacilitator, this will be quite interesting, since sh /he provokes more reflection from participants and will learn with that a lot with that. For instance, we have introduced group leader beginning cycle three and a peer evaluation of assignments in the fourth cycle, where participation will be intense and sensible. Parallel to that, one should advice participants to collect, edit and publish reflections in form of feedback. This is a knowledge construction level, as stated by Gilly Salmon [46].
- Finally, the whole actions and tasks performed shall be documented. Profile of participants need be also updated. Reflective feedback ought to be presented or published. All in all, a learning ePortfolio-based reflective feedback on the online learning process and performance will be published as evidence of learning. The option of using this ePortfolio - based reflective feedback will be left for eFacilitators and the education organisation-either using it as an assessment or credential or PDP (personal development plan). This needs a cautious evaluation of the curriculum.

Chapter 7

Conclusion and Recommendation

This chapter summarizes and concludes the overall research results and findings of the thesis by focussing on three issues. These are contextualisation of the concept of eLearning to the settings of DCs; the research design and process; and the case studies and the findings. Finally, a recommendation to further researches is presented.

7.1 Summary and Conclusion

7.1.1 Conceptualising and Contextualising eLearning

For the last few decades, ICT use in education has been extensively discussed both as field of studies and as a set of tools to enhance learning. With the elapse of time, eLearning as a concept has emerged and inundated the facets of education and training without leaving room for exception. However, when it comes to developing countries (DCs), it seems that eLearning is at a crossroads between opportunities and challenges, as well as controversies on challenges.

The opportunities are tackling problems of access, quality and equity of higher education in DCs through life-long and life-wide learning, and leapfrogging to a knowledge-based socio-economic system, as it has been acclaimed in industrialized countries. The challenges in promoting sustainable eLearning are technological infrastructure, scarcity of skilled experts and absence of traceable best practices (cases studies) that can be benchmarked.

Controversies and paradoxes on challenges are based on constraints in the prevailing technological infrastructure particularly Internet connectivity which is fundamental for eLearning. Discussions that have less concern on the technological infrastructure argue as follows. Firstly, for more than two decades, the emergent and pervasive ICT have been diffused in all facets of human activities including education enhanced by way of global technological 'solutions'-push and internal educational problems-pull factors. Secondly, ICT are at constant innovations while the prices are also dwindling to the extent of being affordable by many. Thirdly, eLearning is not merely a technology driven system, but it is also an organisation enhanced (mediated) and learners' centred (focussed¹) system. The latter rather offers comparative strategic advantages to DCs to amass human resource capital.

Based on the investigation this thesis undertook, eLearning has been considered as a socio-technical network of actors (technological infrastructure, educational organisations and the eLearning society), rather than singling out individual actors. Therefore, it was concluded that the conceptualisation and contextualisation of the eLearning environment and eLearning process in DCs is recommended to be studied from the point of view of a network of actors.

Moreover, critical success factors within the network of actors have been identified and defined. Subsequently the role (or impact) and relationship of each critical success factor to individual actors was thoroughly and continuously assessed and evaluated. This thesis has laid a cornerstone by selecting and defining and evaluating the role of four basic critical success factors such as access to and use of technological infrastructure requirements; the self-efficacy of Internet use for eLearning; group-based online learning and eFacilitation and lastly use of ePortfolio for reflective feedback, in the context of promoting sustainable eLearning in DCs.

7.1.2 The Research Design and Process

The methodological approaches to the research were designed based on qualitative research methodologies, namely action research, case study, grounded theory and situation analysis. Each case study consists of four iteratively realised phases, i.e. problem definition and elaboration; problem abstraction and modelling; implementing

¹in the sense of active participation as one of the most important stakeholder in eLearning system

defined problems and designed models; and finally analysing and reflecting on findings. In sum, the overall process constitutes a learning cycle². Data collection and sources were mainly carried out through guided interviews, emails, log files, discussion fora, and ePortfolio. Finally, collected data were classified and sorted mainly with memos and mapped to the critical success factors which are attributes of the artefacts of each actor in the network of eLearning actors, as briefly discussed and diagrammatically summarised in chapter 4.

The methodological approaches and the research design adopted are qualitative research methods. This was mainly because, an action research supported by cyclic case studies was necessary to continuously and iteratively assess and evaluate the steadily changing eLearning and the network of actors in general and the critical success factors in eLearning in particular. In addition to that, data collection, processing and analysis have also been based on grounded theory, which is one of the categories of the qualitative research methods. With this, four iterative case studies have been realised within three years.

In conclusion, the research was designed based on qualitative research principles by systematically combining various methods to enrich and invigorate the process of assessment, evaluation and reflection of findings. Models were designed to give insight into the research process, such as the four cyclic and iterative diagrams. And the mapping process starting with the actor's network down to the attributes as critical success factors and from data collection source to reflective feedback are replicable in similar undertakings.

7.1.3 Case Studies and Findings

As it has been thoroughly discussed in different scenes of previous sections, this thesis has realised four iterative case studies based on specific research questions, which have mainly evolved out of the findings of the preceding case studies. The main problem domains were the eLearning environment (at the technological i.e. hardware and software level) and the eLearning process (application level) in the context of DCs on one hand. And on the other hand were problems of capturing persistent information, storing and publishing as feedback to stakeholders in eLearning so that the quality and the sustainability of the eLearning program were ensured.

²Every experimental cycle is a learning cycle [41]

Case Study	Problem Analysed	Findings
One	Technology Access (TA) and Use (TU)	LMS was seldom used communication was limited to Emails.
Two	Self-Efficacy to Internet Use (ISE)	Access to the LMS has decreased; eLearners preferred meeting face-to-face. Thus, it was difficult to evaluate ISE.
Three	Group-based eLearning with international participants	Use of the LMS and communication was still limited; group-based learning was difficult due to limited information about peers and their problems of lack of communication and eFacilitating was also difficult.
Four	ePortfolio use for reflective feedback	Feedback from eLearning environment and learning process has been processed and published; thereby access to the LMS and communication and eFacilitation was improved.

Table 7.1: Brief Summary of Problems analyzed and Findings from the Case Studies

The eLearning environment basically constitutes the required hardware and software while the eLearning process comprises the intended communication, interaction, group or collaborative, eFacilitating, continuously updating the eLearning materials, etc. All these make up the critical success factors, of which some selected ones are continuously assessed and evaluated with the case studies.

The first two case studies were specifically focussed on evaluating access and use to the eLearning environment in the context of the Ethiopian higher education. Whereas, the third and the fourth case studies were more focussed on the eLearning process in the context of eLearning environments of the DCs. A summary of the problem areas and findings from the case studies is provided as follows:

The problems analysed and the findings provided in Table 7.1 are only brief summaries of the details of the problem definitions, problem abstractions and modelling and analysis and findings. Worth mentioning at this point are problems assessed in preceding case studies which are also iteratively reassessed along with the specific problems that the case study is concerned with. On the other hand, for each case study, models that have been designed to assess problems are also extended whenever new problems were included. All in all models, i.e. models realised by the case study were added as packages on top of the two dimensional actors network model initially

designed, as discussed in chapter 3.

With this, the overall model can be seen as a three dimensional model, where the assessment begins at the top focussing on technological infrastructure and moving downwards with every extension i.e. including the learning process and viewing from educational organisations and eLearners point of view, until it ends in the middle connoting a balance between three of the eLearning actors.

Finally, the contributions of the overall realised case studies are briefly summarised as follows.

1. **Case Study I:** Assessed the eLearning technological environment in the context of the Ethiopian (typical example of DCs) higher education. This effort was made to identify from where and with what bandwidth capacity eLearners access the LMS and Internet, which is part of the final model for eLearning technological infrastructure.
2. **Case Study II:** Assessed eLearners' self-efficacy to Internet use for eLearning. This has initiated self-assessment in general and Internet use for learning. This has laid down a vital concept for reflective feedback that has been realised later in case study three and four.
3. **Case Study III:** Assessed how eLearners from different countries with different access to Internet learning in groups use the online eLearning environment. With this the thesis has designed a model for group-based eLearning and eFacilitating a larger group of online learners.
4. **Case Study IV:** Designed, developed, and realised a prototype ePortfolio to collect, process, store and publish (view selected from the repository of artefacts) reflective feedback from the eLearning environment and eLearning process. The contributions of the fourth cycle of the case studies are efforts made to define artefacts specific eLearning in DCs, design, develop and implement a prototype ePortfolio.

7.2 Recommendation

This thesis has addressed quite complex issues ranging from eLearning to ePortfolio use in eLearning, from ePortfolio use for reflective feedback to the enhancement of eFacilitation of heterogeneous intercultural groups. Nevertheless, there are obviously still undiscovered or not deeply investigated issues, due to scope limitations. In this regard, the following research areas are recommended for further research ahead of time. These are:

1. Developing the prototype ePortfolio (BeP) based on the model designed, and implemented in real-life projects and also integrating or embedding it in LMS
2. Integrating the artefacts of access to and use of technological infrastructure defined and modelled with a special focus on the realities in DCs and extending the existing accessibility and competency artefacts in IMS-LIP specifications
3. Developing application tools to analyse the patterns of communication and interaction using the MSC-based scenario model for feedback, as discussed in chapter 6
4. Mapping ePortfolio-based feedback to the eModeration model presented by Gilly Salmon [46]
5. Analysing the semantics of the discourse and the reflective feedback continuously collected from the intercultural group-based online learning

Finally, the thesis recommends that, based on the findings and learned experiences, eLearning in particular in DCs should be studied as a complex socio-technological and organisational network of actors taking into considerations the continuous change. This results not only in the understanding of the realities in eLearning in DCs, it also considers the mutual co-existence of actors i.e. technological infrastructure, educational organisations, and the learning society, whose action within a defined network promotes eLearning. Moreover, through increased opportunities, it can be considered, strategically, as a comparative advantage³ to DCs.

³Due to their high human resource potentials that might be mobilized and realised as a knowledge-based capital formation, through eLearning.

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