INFORMATION TECHNOLOGY
FOR E-LEARNING IN
DEVELOPING COUNTRIES

Master’s (one year) thesis in Informatics (15 credits)

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Abstract
E-learning is a rapidly emerging concept facilitating learners in the field of education. Continuous advancements in information technologies are enhancing the possibilities of its growth. Developed countries have realised its strength and adopted it warmly but in developing countries it is still a new concept. There are many limitations in developing countries for its implementation and growth. In my research I have identified the core limitations associated with the growth of E-learning in developing countries and found out some possible solutions. I have selected different subject areas which can support in solving my research questions. In the textual analysis I have found that different cultural, technological and awareness problems are creating obstacles for its implementation. In the empirical survey these problems are verified from the students and teachers who are associated with E-learning and would like to see its implementation in developing countries. In the results of my research findings I have shown how information technology can be helpful for enhancing the possibilities of E-learning and identified how sub systems of E-learning can support its growth.

Keywords: synchronous and asynchronous communications, human computer interaction, cognitive psychology, Usability.
Acknowledgements

E-learning is a rapidly growing area in the field of informatics. This thesis is providing a comprehensive overview of the possibilities and limitations for implementation of E-learning within developing countries.

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Boras March 2011

Rabia Arfin Bukhari
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5
INTRODUCTION

This introductory chapter describes the background of the problem areas and explains why there is a need to research further. The research questions, which form the basis for theoretical and empirical research, are well presented in this chapter.

1.1 Background

Globalization as a consequence of information and communication technology has changed the ways of living and thinking and man has greatly benefited from the facilities provided by information technology. It has also evolved learning and education mechanisms. Learning is a process in which people get information, to enhance their knowledge for improving their performance (Rosenberg, 2001). There are different sources through which information can be acquired; however it is of great concern of how much this information is beneficial for its users. If the information is in an organised form, then a purposeful learning goal can be achieved easily. Currently, there is the emergence of new and modern information technology programs that are instrumental in organisation and delivery of information. When information is delivered electronically, with the support of components of information technology like a computer or computer networks etc then this is called E-learning.

Derek Stockley defines E-learning as an electronic delivery of learning, training or education programs. E-learning requires the use of a computer or electronic device (e.g. a mobile phone) in specific way to provide learning, educational or training material (Stockley, 2003).

Information technology has helped to change the learning and teaching methods with proper use of computer and computer networks. The traditional way of learning through accessing a classroom physically, is not necessary nowadays in developed countries. Students can learn when they want and from where they want using a computer and computer networks. They are not bounded by time and boundary. Information technology not only provides support for the delivery of learning or training material but also it helps to organise, rearrange, reuse and store the learning material. P.Hitch and MacBrayne (2003), proposed a model which describes how information technology is effectively supporting E-learning:

![Figure 1: Effectively Supporting E-learning System (Hitch and Mac Brayne, 2003).](Image)
From the model it is seen that an E-learning System is formed with information technology that facilitates the instructors/faculty members by providing training, technical support, curriculum design, procedures and other services for performing multiple functions. While at the same time it provides different facilities like library services, advisory services and a purchase resource facility to students. On campus and off campus help is available at both ends.

According to Lahad, Dafoulas, Atkinson and Murphy (2004), some of most prominent benefits of E-learning are that it is less time consuming, comprises of simple processes that do not require lengthy processes for delivery of learning material. E-learning contains standardised content without the requirement of continuous change and structure updates and needless human resources for proper functionality. They further claim that with the support of the internet, education is shifting toward constructive or learner centric paradigm, thus the role of instructor has reduced. On behalf of this paradigm learner are able to select what, when and how they have to learn. The beauty of E-learning is that it does not have geographical barriers; anyone from anywhere can achieve its benefits. The key advantage of E-learning is that it has introduced many learning styles and has enhanced the communication and collaboration of learners. The learners who are shy or not able to get face to face education can get extra benefits through this system. Developed countries are using E-learning systems for the delivery of information within their organisations and educational institutions. They have taken the initiative to promote numerous learning opportunities for their citizens through E-learning Systems. Well informed communities in the world are ahead to grasp the benefits of E-learning. Evidently, E-learning is still a new concept in developing countries. Lahad, Dafoulas, Atkinson and Murphy (2004), argue that the developing countries are still using traditional ways of getting an education because of their lack of resources and infrastructures. They are not able to use/get the full benefits of E-learning. The people in developing countries who don’t have time to attend classes due to other commitments are not able to acquire further studies. They also lack study materials and teachers in their premises. This is creating an obstacle for the development of people in developing countries. These countries have their own problems and deficiencies which are hindering proper implementation of E-learning. According to my opinion, if developing countries were aware of this new phenomenon and adopt it warmly, then E-learning would provide an avenue to eradicate economic, social and political problems. Dr. Wolfram LAASER in his report has talked about the virtual universities of African and Arab countries. This shows that developing countries are trying to implement E-learning in their countries, but because of lack of resources and infrastructure they are unable to implement fully functional E-learning systems. Therefore this area is of great interest in informatics.

1.2 E-learning with informatics perspective

Informatics is a science which deals with development and use of information technology in different contexts (Lind Ann, 2005). Gammack, Hobbs and Pigott (2006), define informatics as the process of information handling usually supported by technology. Informatics in the field of education is used for the processing of information and reengineering of information systems (Wikipedia, 2011). E-learning is a system in which information is collected and organised in a way that could be helpful for learners. In the context of E-learning, the collection of information and its organisation is called knowledge management. Information technology is facilitating E-learning with its advancement and widening its scope but developing countries are unable to implement E-learning systems properly.
1.3 Statement of Problem

The developing countries are not able to use E-learning or unable to get full benefits of E-learning. The inability of the developing countries to get the benefit of E-learning has hindered lots of people in achieving further studies, enhancing their knowledge and lifestyle. Some of developing countries are trying to adopt fully functional E-learning systems but they are unable to achieve all the benefits. E-learning Systems have become the need of time, so some of the developing countries are spending funds for the acquisition of these systems but are unable to achieve purposeful goals.

Most of the developing countries have common problems like lack of infrastructure, resources and awareness. In some countries the culture and mindset has become a big obstacle for the implementation of E-learning systems. Their institutes and governments are struggling for fully functional E-learning systems, but all efforts seem to be worthless. In my thesis, I will investigate how these problems can be resolved with the support of information technology which are creating obstacles for the implementation of E-learning systems in developing countries.

1.4 Purpose of Study

E-learning is not fully implemented in most of the developing countries and the purpose of my study is to find out why E-learning is unable to fully take-off in these countries. The purpose of this thesis is to create an understanding of possibilities and limitations of E-learning systems in developing countries. I will also address how to increase the possibilities as well as to reduce the limitations with the support of information technology.

Many new components of information technology for E-learning have introduced and developed countries are using these components effectively. Developing countries are still trying to introduce basic E-learning components; however, they are not successful for the full implementation of E-learning systems. In my thesis I will mention the principals which can support the implementation of E-learning systems, with the help of new information technology components. For the conduction of this research, one main question and some sub-questions are designed below.

1.5 Research question

Based on the problems in developing countries for the implementation of E-learning system, the following research question and sub questions are listed below arise.

**Main Question:** How can information technology be used to improve E-Learning in developing countries?

**Sub question 1.1:** How can information technology be used to support learning in developing countries?
Sub question 1.2: What important design principles can be used to create a more efficient HCI for e-learning?

Sub question 1.3: How can information technology be used to improve communication for E-learning in developing countries?

Sub question 1.4: How can information technology be used to increase the possibilities and reduce the limitations for E-learning in developing countries?

In this study, the potential and boundaries of E-Learning in developing countries will be identified, analysed and discussed. E-learning can have immense impact on developing countries. But how can information technology provide support to E-learning systems in this regard will be understood thoroughly. E-learning will provide a platform to deal with current and future challenges, thus it is necessary to have a clear understanding of the benefits of the E-Learning systems. This research will be conducted for a specific to general target group who can consult this thesis for future research or for the successful implementation of E-learning systems.

1.6 Target Group

This thesis directly addresses professionals who want to implement and improve E-learning systems in various educational institutions in developing countries. In the context of this thesis, professionals can be teachers, system managers and organisers etc. or whoever participates in the implementation of an E-learning system. Professionals will come to realise what principals they should adopt to resolve the implementation problems of E-learning. They can modify their existing principals and will come to understand which new components of information technology can assist them further. When we are talking about professionals, we cannot neglect researchers in the field of informatics, information science, learning management systems and E-learning systems etc. who will consult this thesis for future research.

In addition, this report is dedicated to several other related audiences such as my examiners, tutors, classmates and others who are interested in the field of E-learning but it is compulsory to define some delimitations of research for clarity and simplicity.

1.7 Delimitations

E-Learning is advancing day by day. New technologies are continuously incorporated in the growth of E-learning systems. Most of the developing countries endeavour to adopt modern E-learning systems and it would be complex to address the status of E-learning in all developing countries and their problems in the field of E-learning. This results in why I have limited my research to cover only two countries, Pakistan and Saudi Arabia. The outcome of this research will have a positive impact on the status of E-learning systems in both these countries.
1.8 Expected Outcome

E-learning has evidently changed the shape of education. In the last decade, this field has achieved enormous growth especially in developed countries and the trend is rapidly catching up in the developing countries. However, there are still difficulties for the proper implantation of this field in developing countries. So the purpose of this research is to find out what these difficulties are and identify new tools of information technology which can support and spread E-learning in developing countries. My research will provide valuable support and solutions for the advancement of E-learning systems in developing countries. There is however a possibility that the author's background and experience can influence the outcome of the research.

1.9 Author’s Own Background and Experience

The author’s experience in the field of E-learning is limited to the use of the Internet for searching material, receiving course data from the university, uploading assignments, communication with teachers and other students. In addition, the author has studied some courses in blended learning environments which is also a type of E-learning, but has not taken any full online course. Therefore, the author has relied on sound theoretical and empirical study for this research.
1.10 Over All Research Design

- Background
  - Statement of Problems
    - Create Basis for
  - Research Question

- Research validation Strategy
- Data Collection Qualitative Data
- Research Strategy (Survey)

- Important Concepts
  - Theoretical Study
    - Summary of theoretical findings
      - Theoretical Study Verified Through Empirical Survey
      - Empirical Survey
        - Interview
          - Interview Results
            - Provide input for
  - Provide input for
    - Data Analysis
      - Research Results
        - Conclusion
          - Results Evaluation

Figure 2: Over All Research Design
Figure 2 illustrates an overall research design. Background of research area leads toward the statement of the problem and creates a basis for research questions. After that, the research design describes the research strategy, data collection procedure and strategy for research validation. Data collection procedure will give directions for a theoretical study, which will describe important concepts, which will be further verified during an empirical survey. The results of this theoretical study and empirical survey will provide an input for analysis. The results of the analysis will provide the answers to the research questions, which will in turn create a basis for the conclusion. A defined research strategy will verify the results of the research.
2 RESEARCH DESIGN

This chapter describes the research perspective and research strategy that has been used for conducting the research. The overall structure and criteria of the thesis is presented. In addition data collection techniques have also been discussed.

2.1 Research Perspective

2.1.1 Character of Knowledge

Expertise and skills are acquired by a person through experience or education. The theoretical or practical understanding of a subject is called knowledge as stated by the Oxford Dictionaries (n.d). An individual discovers what something is with the characterisation of knowledge as it describes the meaning of phenomena. Most people regard the phenomena as a normal element of their daily life (Smith, 2007). However, normally a phenomenon is referred to as an observable event. According to the American Philosophical Association Research (n.d.), philosophy of phenomena is (a) an appearance or immediate awareness in experience, (b) Kantianism; a thing as it appears to and is constructed by mind, as distinguished from noumenon, or thing in itself. Therefore, the essence of a phenomenon is achieved by uncovering the existing and reconstructing the symbolic meaning which is associated with phenomena through sound interpretation of characteristics of phenomena. In this regard, characterisation of knowledge in research is generated by conducting theoretical study and carrying out an empirical survey. Since my research is about the information technology for E-learning in developing countries, which is a broad topic. I have to find out the limitations and possibilities for the implementation of E-learning in developing countries, so my character of knowledge will be comprehensive. This character of study will establish the answers about what something is instead of finding why something is. With a comprehensive perspective, I will find out what strategies would be more suitable for the implementation of E-learning in developing countries. What factors can influence, or increase the possibilities while reducing the limitations of E-learning in developing countries. Further, I will determine which scientific perspective is more suitable for my research.

2.1.2 Scientific Perspective

Positivism and hermeneutics are two main scientific perspectives.

Positivistic perspective argues that science is based on observation. Science produces knowledge about the relationship controlled by natural laws. It prefers numerical methods and consequently constructs quantitative measures. Whereas, hermeneutics is the science of comprehension. I need to bring forward a complete understanding of this research. I prefer a hermeneutic research perspective and this perspective mostly prefers qualitative data, though sometimes it uses quantitative data in order to add verification. Hermeneutic covers the linguistic and non-linguistic expression for understanding. Hermeneutics aims at interpretation and explanation of meaningful concepts. Learning theories also argue for an increase in understanding and knowledge
acquisition. Gadamer (1960), has presented the theory of knowledge ‘Truth and Method’, in the perspective of philosophical hermeneutics, whose goal was to uncover the nature of understanding. Human learning also argues for uncovering the facts.

In summary, hermeneutics is the study of interpretation theory which deals with the interpretation of text. People are always trying to interpret the ever changing world around them. They make sense of their world on an individual basis means they personally conduct reality (Pressler, Dasilva 1996). This has great impact on the field of information management. According to Betti (cited in Pressler, Dasilva 1996), hermeneutics is a meta-language of moral science to which epistemology and methodology are subsumed. Betti wants to show interpretations in the domain of natural science. Betti assumed hermeneutics as a “continuous movement of interpretation towards the capture of object analysis of it complex meaning”.

Hermeneutics also deals with the ontology of constructivism. Other perspectives are critical theory and phenomenology which describe the human experiences on certain phenomena i.e. ‘things themselves’ (Sutton 1993 p. 414 cited in Pressler, Dasilva 1996). According to Oates (2006), interpretivism includes approaches based on hermeneutics, phenomenology or constructionism.

- **Interpretivism**

As compared to positivism, interpretivism does not deal with hypothesis but it analyses, examines and explains how all factors are related to or are independent from each other, especially in social settings. How people individually, or in groups perceive their world, the meaning of phenomena and their values given by people is apprehended in interpretivism. The basic idea is to create an understanding in an organised way, how people create sense of their perceived world and how these perceptions differ from each other over time (Oates, 2006). Interpretivism has the characteristics of:

- multiple subject realities
- dynamic and socially constructed meaning
- research reflexivity
- a study of people in their natural and social settings,
- qualitative data analysis
- multiple interpretations

Interpretivism which is associated with the school of hermeneutics deals with qualitative data and positivism deals with quantitative data for research.

### 2.1.3 Quantitative research and Qualitative Research

*Quantitative research involves gathering of data that is absolute, such as numerical data, so that it can be examined in an unbiased manner as possible. There are many principles that go along with quantitative research, which help to promote its supposed neutrality (WiseGeek, 2011).*
According to Oates (2006), quantitative data is that which is based on numbers. The assumption behind this approach is that there is an objective truth existing in the world that can be measured and explained scientifically. The main concern of this approach is that measurement is reliable, valid, and generalises in its clear prediction of cause and effect (Cassell and Symon, 1994). According to Oates (2006), quantitative data may comprise of nominal data, ordinal data, interval data and ratio data etc. that may be discrete or continuous. Sometimes research needs accurate counts rather than highly sophisticated and detailed studies.

Qualitative research is used when a deep understanding of a problem is required. In this type the data is in the form of text or pictures. For conducting this kind of research, a high level of observations and in depth interviews are required to get the complete picture of problem areas. In the case of quantitative research, researchers know from the start - what is exactly required, but in the case of qualitative research - facts come up with the passage of time. Qualitative researchers aim to gather an in-depth understanding of human behaviour and the reasons that govern such behaviour (WiseGeek, 2010). It is a naturalistic observable fact and concerned with the understanding of meaning, which people attach to phenomena of actions, decisions, beliefs and values within their social worlds (Denzin and Lincoln, 2000). The way in which people are studied, understand and interpret their social reality is one of the central motifs of qualitative research (Bryman, p.8, 1988). Such study is especially useful for the researcher in the case of Who? What? and Where? (Sandelowski, 2000).

According to the hermeneutics point of view, I have used qualitative research methods. For my research questions, it was necessary to have the complete understanding of the problem area, so selection of research strategy was very important.

### 2.2 Research Strategy

A research strategy is a plan of action that gives direction to your efforts, enabling you to conduct research systematically rather than haphazardly (Ferguson, 2005). Every research has some specific purpose.

#### 2.2.1 Research Purpose

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<tr>
<th>Purpose of Study</th>
<th>General Research Questions</th>
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<tr>
<td>Exploratory</td>
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<tr>
<td>- To Investigate Little understood phenomena</td>
<td>What is happening in this social program?</td>
</tr>
<tr>
<td>- To Identify or discover important categories</td>
<td>What are the salient themes, pattern or categories of meaning for the participants?</td>
</tr>
<tr>
<td>- To Generate Hypothesis for further research</td>
<td>How are these patterns linked with one another?</td>
</tr>
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Table 1: Matching Research Question and Purpose, Source: Marshall and Rossman (2010)
Since my research is for finding the possibilities of E-learning with the support of information technology, the purpose of my research will be explanatory. With this purpose, I will be able to find out which new components of information technology can help learners through E-learning to improve their skills. I will also be able to define which important interaction design principals and communication perspectives can improve the implementation of E-learning in developing countries. For this I will use the specific research strategy.

### 2.2.2 Strategy Basics

Researchers mostly use case studies, surveys, experiments, and design study research strategies to solve the research problem. Research strategy however, depends upon the research questions, the need for control over behavioural events and the degree of focus on contemporary versus historical events Yin (1994).

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<th>Form of Research Question</th>
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<th>Focus on contemporary events</th>
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<td>How, Why</td>
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<td>Yes</td>
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<td>Survey</td>
<td>Who, What, Where How, How much</td>
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<td>Yes</td>
</tr>
<tr>
<td>Archival Analysis</td>
<td>Who, What, Where How, How much</td>
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<td>Yes/No</td>
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<td>History</td>
<td>How, why</td>
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</tbody>
</table>
In this research, I cannot perform an experiment as it is not the requirement of the research question. A hypothesis for testing is required when designing for experiments. According to Oates (2006), a hypothesis is a variable for measuring and controlling external and internal validity. In this research I do not have such a hypothesis, so an experiment is not suitable. Archival analysis is not possible for this research at this point because archival research needs census data, newspaper clippings, birth certificates or previous records. For my research I want to know what is going on now and what can be done in the future for which archival data will not be sufficient. History is not suitable for this research because the focus is on contemporary events. My research is not in a specific area/region so a case study is also not possible. Therefore, I feel the most appropriate research strategy for this research is by conducting a survey, from which an in depth understanding of the problems can be obtained.

- **Survey**

A survey is basically used to gather information from different people to resolve the problem. Surveys are conducted when the same type of data is required from a large group of people in an organised way (Oates, 2006). According to Fink(2003), a survey comprises of several activities:

- setting an objective for information collection
- study design
- preparation of survey instrument
- conducting surveys
- data analysis
- reports
- results

Survey instruments have four forms: self administrative questionnaire, interview, structured record reviews and structured observations.
Figure 3: Survey Activities
For my research I will conduct a survey in different phases. In phase one, the background, the current situation and upcoming trends in the research area will be studied. Alongside this, the problems and current situation of the subject area will also be studied. After which, I will study designs and select a survey instrument. My survey instrument will be an interview, for which I will prepare questions. I will test the questions and adjust them accordingly. Interviews will then be conducted and data collected. Analysis of data will be carried out from which the results will be prepared.

2.2.3 Role of Theoretical and Empirical part of Research

During a research we cannot neglect the role of the theoretical and empirical part of research. Actually, the whole research constructs on the base of theory. For finding the validity of the theory the empirical part of research is necessary. Theory informs the research process and helps to direct it. Researchers find out theories which support the investigation of their research questions. Sometimes, on behalf of other theories researchers construct their own theories. In my thesis I will use learning theories for defining the acquisition of knowledge through computer mediated components. Learning theories will support the level of understanding and different ways of receiving information. After the theoretical part, then comes the empirical part of the research which verifies theoretical findings. This shows that the whole process is based on deductive reasoning, which starts with the theories and ends up at confirmation. But according to Research Method Knowledge Base (2006), inductive reasoning by its nature is more open-ended and exploratory especially at its beginning. So in my research, I will also use the inductive reasoning method of research and study the views of different researchers relating to my research questions. The empirical part of research considers the experiences of the society. On behalf of those experiences and theoretical findings, researches try to come up with new knowledge which could be a base for future research. However, both theoretical and empirical parts of research rely on the data collection procedure.

2.3 Data Collection Procedure

Data collection is an important part of any research because inaccurate data can have inaccurate results. There are two basic sources for the collection of data: theoretical source and empirical study.

2.3.1 Different Alternatives

*Text Analysis*
Identifying, searching, locating, synthesising and analysing the conceptual literature, reports, articles, conference papers, books and thesis are part of theoretical source. To search the written text and analyse that text is an essential part of the research. The risk with this method is that if the text collection is not from reliable sources, then it could divert the researchers from their objective.
Interview
According to Oates (2006), an interview is a special kind of discussion amongst people. It has set of assumptions that are not the part of normal conversation. Behind the interview, the interviewer has a specific purpose. The interviewer wants to get information from others. So it is a kind of planned discussion, not by chance discussion. According to Yin (1994), an interview is the most important source of data collection. The interview can be done through direct interaction, telephone or e-mail. The purpose of an interview is to collect data, related to a certain problem through the views of people. The risk with this technique is that this process is long and time consuming and sometimes interviewees do not respond properly.

Questionnaires
Questionnaires are an easy and reliable way for collecting data which can be answered by individual or by groups. A questionnaire contains a series of questions, used for gathering information from respondents (Wikipedia, 2010). A questionnaire has an advantage to collect multiple responses. There can be different types of questions in a questionnaire for any research. Some of which are listed below:

- Contingency Questions- this type of questions only have a particular response that is related to the previous question.
- Matrix Questions- As the answers to these kinds of questions, identical responses can come for multiple questions. The questions are arranged in a way that they form a matrix, with response categories along the list of questions down the side.
- Close ended Questions- are the type of questions in which answers are fixed or limited to the response set. The answers can be yes, no or there could be multiple choice.
- Open ended questions- are those in which the response is not predefined.

Observation
Observation is a kind of data collection method in which researchers have to be the part of the environment. With observations the need is to pay attention to what people actually do instead of relying on what they report they do (Oates, 2006). I have studied in a blended learning environment but presently, I cannot be the part of an E-learning system in developing countries. Therefore, I will not use the observation method.

2.3.2 Theoretical Study: Text Analysis

Literature Review
A literature review is compulsory in research because without it understanding of topic cannot be acquired. According to Hart(1998), a literature review is “What has already been done, how it is researched, what the key issues are”. In order to have a deep understanding, it is necessary to have an extensive study about the area.

I have started studying the history of E-learning, its status and factors which could involve for its growth in developing countries. During my research, I will study various books, journals, articles, recommendations prepared by domain experts and other internet sources to conduct a well familiarised theoretical study. E-learning is a system which comprises of many subsystems, so the
bulk of data is available. It is a difficult task to sort out data which is supportive of my research. I will make complex decisions for the selection of data. I will select different books written by different authors and printed by authenticated press relevant to E-learning systems and its subsystems. I will use an online database and library provided by the University of Boras. I will also study the theories associated with learning and E-learning and the factors which are associated to E-learning and its subsystems. This research is aimed for developing countries, so it is necessary to study about the limitations of E-learning in these countries. For some definitions and understanding the concepts, I will also use search engines. On behalf of the theoretical study I will perform an empirical survey.

2.3.3 Empirical Study: Interview

Getting the in-depth understanding of the research area, an interview is the best technique for data collection. During interviews; expressions, actions and attitudes of interviewees can be monitored easily.

Types of Interviews

- Structured Interview

Structured interviews are normally used for quantitative research. For this kind of interview questions are already prepared. According to Oates (2006), structured interviews use “pre-determined, standardised and identical questions for each interview.” The interviewee gets and reads the questions, then answers them. The questions are normally close ended, but sometimes open ended questions can also be used. A social interaction can be built during the interview, because the interviewee can ask for more clarification from the interviewer during the interview. The main advantage of structured interviews is that they provide uniform information.

- Semi-structured Interview

These types of interviews have open ended questions, which allow new questions to arise during the interview. Researchers collect data from textual information. According to Oates (2006), these kinds of interviews provide facility to change the order of the questions according to the flow of conversation. More questions can be added if the interviewee prompts an issue for which the questions have not been prepared. The basic purpose of these kinds of interviews is to get an in depth knowledge of the problem, because the interviewee can speak in detail.

- Unstructured Interviews

In these kinds of interviews, the researcher has less control. The interviewer just gives the introduction of the topic and the allow interviewee to develop ideas and the opportunity to discuss comfortably related topics, events, behaviour and beliefs. In this instance, the interviewer should not stop or interrupt the interviewee (Oates, 2006).

I will collect textual data from different books, websites and journals. In addition to that, I will prepare questions for interviews. I have to understand the core problems associated with the area, so it would be better for me to adopt the semi-structured interview technique. With this technique
I would be eligible to prepare both closed and open ended questions for my interview. This technique will also allow me to raise new questions during the interview. These interviews will be conducted in order to get the views from others for the growth of E-learning and how its implementation could help in increasing the level of education. All interviews will be conducted to professionals in the field of education in developing countries. The internet will be used as the media for conducting the interviews. After theoretical and empirical data collection, data analysis will be done.

2.4 Data Analysis Procedure

Data analysis is a practice in which raw data is ordered and organised, so that useful information can be extracted from it. The process of organising and thinking about data is the key for understanding, what the data is about. What it contains and what it does not contain.

2.4.1 Text Analysis

Text analysis is required in order to identify what aspects are related to the problem area and to understand what the actual problem is. Data analysis is a practice in which raw data is organised so that useful information could be extracted from it. The research approach used is Ricoeur's hermeneutics. Ricoeur (1913—2005 cited in Kim, 2005), introduces three stages of interpretation that he called mimesis. Mimesis 1 is pre-figuration, Mimesis 2 is configuration and Mimesis 3 is re-figuration. Mimesis 1 is a human action which is predefined and has basic competence i.e. competency in conceptual network. Pre-figuration is pre understanding of practical life. It is associated to someone acts, sets goals, uses means, enjoys, success or suffers etc. (Coff, 2006).

Mimesis 2 deals with the imaginative configuration of the element described in Mimesis 1. Mimesis 2 is associated with creative activity that composes the actions of narratives. Configuration deals with the activity which unfolds in writing of both history and literature (Coff, 2006). Mimesis 3 deals with the imaginative or fictive perspectives and completes the mimetic process. With it we refigure our lives, open up a new world and reconstruct our field of action (Coff, 2006). Hansson (1999 cited in Lind, A. 2005), describes three steps in Ricoeur’s mimesis: pre-figuration, configuration and re-figuration. Pre-figuration takes its starting point in the reality, existing when the text was written. For example, it could be structured norms and values. The second phase, configuration is reading the text where the focus is on the presentation of norms and values of the daily world. During the third phase re-figuration, a synthesis of the two previous phases is created, thus paving the way towards a meaningful basis for interpretation. These phases will be used in the analysis of theoretical material and empirical data.

2.4.2 Empirical Survey Analysis

After theoretical research, the empirical research will be carried out with the help of interviews. For checking the validity of empirical research, interviews will be compared with the theoretical
findings. So, this will be a comparative analysis. The analysis will lead towards the checking of the validity of research, for which some strategies will also be adopted.

2.5 Strategies for Validating Finding

Once data has been collected and analysed, then there is a need to validate it. In the validation process it is considered that data is in a form that can be used in the future. The purpose of this Master's thesis is to give the solutions for the implementation of E-learning in developing countries with the help of information technology. So accuracy and validity of data is vital for this thesis. I will collect qualitative data for my research so; reliability, validity and generalisability play minor roles in qualitative inquiry (Creswell, 2003). Validity is normally used to suggest and determine that findings are accurate from the standpoint of researchers. Trustworthiness, authenticity and credibility are bound to qualitative literature (Creswell, 2003). According to Lincoln and Guba (1985), there are two main categories of criteria for evaluation.

<table>
<thead>
<tr>
<th>Positivism</th>
<th>Interpretivism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Validity</td>
<td>Trustworthiness</td>
</tr>
<tr>
<td>Objectivity</td>
<td>Conformability</td>
</tr>
<tr>
<td>Reliability</td>
<td>Dependability</td>
</tr>
<tr>
<td>Internal validity</td>
<td>Credibility</td>
</tr>
<tr>
<td>External validity</td>
<td>Transferability</td>
</tr>
</tbody>
</table>

Lincoln and Guba (1985) presented criteria for checking the quality of interpretive research as compare to positivist research.

- **Trustworthiness**
  
  Trustworthiness shows that how much trust can be placed on research (Oates, 2006).

- **Conformability**
  
  In conformability, it is judged that the findings do flow from data and experiences in settings.

According to Oates (2006), conformability can be achieved by audit trail:

- Raw Data: Collection of data items, records, tapes, documents etc.
- Data analysis procedure: Ideas of other researchers during studies and summaries.
- Data Synthesis Procedure: Code schemes created, the code data, theme found, interpretations.
- Process notes: Descriptions of data collection and data analysis.
- Reflection of the investigator: Personal notes and reflexive journals kept by researchers.
- Survey or questionnaire guide: Any forms through which data was collected or semi structured interview questions.
Therefore the dependability of thesis will also be checked.

- **Dependability**

Dependability deals with the recording of the research process and data documentation. Researchers should document the whole research and expect that one could follow it (Oates, 2006). I will present data according to the template provided by the University of Boras. For referencing, the Harvard referencing system will be used, so that others will follow my research and thus increase the credibility.

- **Credibility**

Credibility according to Bryman (2004), means how much the results are reliable and accurate. According to Oates (2006), credibility of research ensures that subject of inquiry was accurately identified and described. The credibility of research depends upon on the source of data collection, presentation of the material to the people for whom the research has been conducted. For my research, I will use different books, journals and will do an empirical survey with the people relating to the subject area, so that my research will become credible and transferable.

- **Transferability**

Transferability according to Bryman (2004), is that “The set of findings is relevant to other settings than the one or ones in which it was conducted”. I will try to ensure that my research will be transferable to others and not unique to those who will become part of my survey. Detailed descriptions (detail account of research setting according to Lincoln and Guba 1985), will increase the transferability and the possibility to generalise results. I will compare my theoretical findings with the empirical survey, which will also increase transferability. Appropriate presentation methods will also improve comprehension of thesis.

### 2.6 Result Presentation Method

After the analysis and validation of data, it is important to present data in such an expressive way that it should be helpful for its consultants and give way for future research. For the presentation of research, different methods will be used i.e. theoretical writing, tabular representation, graphical representation and models etc. The research has started with theoretical writings. The research will be presented with the help of tables and theoretical explanations. Figures will be used to elaborate the research.
3 THEORATICAL STUDY

This chapter provides important key concepts which are relevant to the studies. Give an introduction to the subject areas which are presented in the thesis and their relation to the research questions. Previous research is also described.

3.1 Key Concept

In this section, I will briefly explain some important concepts to facilitate the understanding of the text. The concepts are more thoroughly elaborated later in the thesis.

3.1.1 Blended Learning

Blended learning is a form of learning which gives an opportunity to incorporate technology to traditional learning. In blended learning, technology supports to change pedagogical ways and helps learners within and outside the class. Computer based or web based technologies integrate with blended learning.

3.1.2 Computer Based Training

From this kind of training, students learn to use computers with the support of different software, CDs, DVDs and LAN etc.

3.1.3 Web Based Training

WEBOPEDIA (2010) explained web based training as instructions delivered through the internet or intranet using a web browser. Web based training includes streaming videos, audios, hyperlinked web pages, live web broadcasts, and portals of information and interactive methods such as bulletin boards, chat rooms, instant messaging, video conferencing and discussion threads.

3.1.4 Virtual Learning Environments

Virtual learning environments (VLE) are the software which helps to enhance learning and teaching. Students use computers and the internet during the learning process through virtual learning environments. VLE helps to manage knowledge, students tracking, online support for students and teacher through electronic communication. Students and teachers can interact in VLE through designated ID’s and both have specific rights to perform certain tasks. However,
teachers have more rights than students. Blackboard, WebCT, Moodle etc. are most commonly used virtual learning environments for E-learning systems.

### 3.1.5 Asynchronous and Synchronous Communication

In the new era, personal growth and success depends on his/her knowledge and how much he/she is well informed. It does not matter how that person is acquiring the information. When we talk about the information acquisition through E-learning then two basic types of E-learning comes to front, asynchronous and synchronous. The start of E-learning was with asynchronous but with the improvement in the quality of the internet and emergence of new software synchronous type gained more popularity.

![Figure 4: Time Space Matrix Source: Tim Daniels and Melinda(2005)](image)

#### A Asynchronous

In asynchronous learning, normally teachers and learners communicate via email, discussion board or a shared website even when both are not online simultaneously. Teachers usually upload course material on the website and learners access this material at anytime and from anywhere at their comfort.

- **Self Paced Courses**
  Self paced course material can be delivered through the internet, intranet or local network, CDs or DVDs with the features of multimedia, interactivity, bookmarking, tracking, simulation online experts, multiple bookmarks, notes and highlights.

- **Discussion Groups**
  Discussion groups can also be known as message boards, bulletin boards and discussion forums. Discussions by different people at different times are indicated on the discussion board. On the discussion board the question can be posted by anyone and which any other member can be answer. Teacher can also start an open discussion for the class.
B Synchronous

In synchronous type of e-learning teachers and students have to be online at the same time and they talk face to face with the support of video conferencing software or through chat. But students and teachers do not have to wait for the response from both sides.

- **Virtual Class Rooms**
  Within virtual class rooms, students and teachers work as they work in real classrooms. Students and teachers come online at the same time. Teachers can take an attendance; ask questions to students and vice versa. Students can raise hands for asking the question when they are talking on video conferencing. Different ways of delivering lectures are slide presentations, audio/video conferencing, chat, shared whiteboard, application sharing and instant messaging etc.

3.1.6 Learning/Knowledge Object

Learning objects are small chunks of instructions or information that can stand alone. Knowledge objects are basically a collection of small contents or practice items which help learners. By creating the object libraries, these objects can be reused or combined with other objects. These objects can be curriculum, information objects, testable objects, training components etc.

3.1.7 Human factor

This is the study of how to introduce information systems to human beings and make their work life easier (Berg, 2003).

3.1.8 Usability

A computer system is effectively manipulated by the user in order to assist in performance of tasks (Berg 2003). Usability is therefore associated with the functionality of the system.

3.1.9 Interface design

Interface design is the part of HCI and is related to input, output devices such as keyboard, mouse, screens etc (Berg 2003).

3.1.10 Possibilities of E-learning
What is supposed to be unchangeable, has been in other times and place organised quite differently and therefore human possibilities are in almost every way greater than we ordinarily imagine (David, 2007, p1). A possibility of E-learning means that, what we can do with the help of E-learning. It’s all about the imagination of the potential of E-learning.

### 3.1.11 Limitation of E-learning

Limitations are the boundaries which interfere with the possibilities after a certain extent. For E-learning systems the limitations are its technologies, without which it cannot be implemented. Other limitations of E-learning systems are that it does not support when physical existence is required for experiments. If learning could not be justified without laboratory work, then that kind of learning could not be achieved from distances by just watching and reading.
3.2 Subject Area Relevant to Research

Figure 5: Subject Areas Relevant to Research
Figure shows the subject areas and their relationship. The figure also depicts which subject areas support which question. A brief description of subject areas is given below:

Learning theories, cognitive learning model shows that how learning could be acquired and how new knowledge could become the part of previous knowledge. A learning pyramid depicts which source of acquiring knowledge is more impressive than the other. Psychology for technology depicts how the use of technology can support and improve learning.

Psychology for technology describes that how technology can complement the learning process. Behaviourism, cognitivism and constructionism are illuminating the concept of technology for learning and enhancing skills. Further it is described how information technology assists learning.

Information technology details the concept of technology and information, its basic components and how information technology is conductive in getting education. What variety it provides for acquiring knowledge is also detailed.

E-learning describes intrinsic concepts of acquiring education through information technology and competence of web based training over computer based training. Different categories of E-learning are also described.

Human computer interaction (HCI) illustrates what the interaction is of human and computer, what the role of psychology is and what important factors involve for increasing the interaction of human with the computer. Also the interaction design principals are described which can be supportive for creating expressive HCI.

Communication and its basic concepts are described. Computer mediated communications and Maletzke’s model for illuminating the concept of computer mediated communication in E-learning is also described. Role of semiotics for E-learning is also illustrated.

Limitations which are creating obstacles in the pavement of E-learning in developing countries are explained in detail.

### 3.3 Previous research

The need for learning has existed since time immemorial. It is a natural instinct that man struggles to learn all the time and man has created different ways to enhance learning. Technology is the partner of a man in his struggle to help him during his learning journey. Technology also supports the field of education tremendously e.g. paper was invented with the support of technology. Numerous subject areas emerged in the field of education when the idea of class formation came into existence. With the increase in population, it became necessary to use different methods to teach students in order to reach a wider population. Thereafter, distance learning was started by Isaac Pitman in 1840. With the passage of time different ways were used
for the spread of education. The University of Houston offered the first televised college credit class via KUHT which was the first public television channel in the US. After the invention of the computer, institutes started using computers in classes for changing teaching style. Graziadi W.D. in 1993, first introduced online computer delivered lectures, tutorials and assessment projects using email and two VAX notes conference along with several software programs. This allowed students and instructors to create virtual instructional classroom environments in science in areas of research, education, service and teaching. Bates and pool (2003), and OECD suggested different forms of E-learning no E-learning i.e. no use of computer or internet for teaching and learning. Lectures on power point slides were available to students through a course to the laptop program, where students were required to bring a laptop in classrooms as a part of face to face classes, to hybrid learning, where classroom time was reduced but not eliminated, to fully online learning, a form of distance education. After the emergence of Web 2.0, a new shape of E-learning was introduced as E-learning 2.0 which emphasised on social learning and use of social software such as wikis, blogs, podcasts and a virtual world such as Second Life. Different new softwares were introduced and the virtual classroom environment became the essential part of E-learning 2.0. Different approaches have been defined from computer based learning to web based learning etc.

Table 4: Dimensions of E-learning, Source: Mahmud and Gope (2009)

<table>
<thead>
<tr>
<th>Approach</th>
<th>Style</th>
<th>Meaning</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synchronicity</td>
<td>Asynchronous</td>
<td>Content Delivery occurs at different times</td>
<td>Lecture module delivered via email</td>
</tr>
<tr>
<td></td>
<td>Synchronous</td>
<td>Content Delivery occurs at the same time</td>
<td>Lecture delivery via webcast</td>
</tr>
<tr>
<td>Location</td>
<td>Same Place</td>
<td>The student uses an application at same Physical Location</td>
<td>Using a CSS to Solve Problem in a classroom</td>
</tr>
<tr>
<td></td>
<td>Distributed</td>
<td>Student Use an application at various physical locations</td>
<td>Using a CSS to solve a problem from distributed location</td>
</tr>
<tr>
<td>Independence</td>
<td>Individual</td>
<td>Student works independently from one another to complete assignments.</td>
<td>Students Complete e-learning module autonomously</td>
</tr>
<tr>
<td></td>
<td>Collaborative</td>
<td>Students work collaboratively with one another to complete a learning task</td>
<td>Students participate in discussion forums to share ideas</td>
</tr>
</tbody>
</table>
| Mode     | Electronically only | All content deliver | An electronically
### 3.4 Relevant Literature Source

I have selected different cognitive authorities for different subject areas and for theories. Three main theories cognitivism, behaviourism and social learning theory have been selected for illuminating the learning process. For these theories, the cognitive authority is learning theories knowledge base. For further elaborating the learning process and how information can become the part of the memory, a cognitive model by Gerald Grow, (1996) Ph.D. is described. Abraham (2010), has used the learning pyramid constructed by national training laboratories, communicates how sources of information impact the learning process.

Friesen (2009), described psychology for technology and shows how psychology and technology work together to improve the learning process according to the beliefs of cognitivists, behaviourists and constructivists.

I. T. L. Education Solutions Limited, Itl (2009), details how information technology can be used for the education in the form of computer based training and web based training.

Friesen 2009, has described that E-learning is a way of getting education with the support of information and communication technology. Blended learning, informal learning, community learning and work based learning are categories of E-learning (Siemens, 2004).

Human computer interaction is the interaction of man with machine. Carroll (2003), showed that human factor, usability and interface design are basic elements which can have a direct influence on human computer interaction. Cooper, Reimann and Cronnin (2007) are cognitive authorities for interaction design principals.

Communication is a process in which messages, signals and ideas transfer from source to destination. The most prominent cognitive authority which I have selected for the concept of communication is Fiske (2002).

There are many limitations in the avenue of E-learning in developing countries but most prominent are technology, culture and lack of technological awareness. I have consulted Tanja Kohn, Ronald Maier and Stefan Thalmann (n.d) for obtaining a deep understanding of limitations for E-learning in developing countries.
3.5 Learning

This chapter introduces what learning is and what are learning theories about the concept of learning.

3.5.1 Learning Theories

Learning is a process through which man, animal and sometimes machine undergoes to improve knowledge. Man and animal also learn from the surrounding environment for making their life easier and for increasing the durability of life. Theory of behaviourism argues that “behaviourism is worldwide and that it operates on the principle of external stimuli” (learning theories knowledge base, 2010). Believers of the behaviour theory claim that learning occurs due to external action. Cognitive theory claims that “The black box of mind should be open and understood” (learning theories knowledge base, 2010). Learning comes through information, mental processes such as thinking, memory knowing, problem solving and starts in the brain when information comes. Bandura believes that the Social learning theory bridges the gap between the theory of behaviourism and cognitivism (knowledge based learning theories, 2010). Social learning theory describes that “people learn from each other via observation, imitation, and modelling.” This theory emphasises on learning through other people’s attitudes, behaviours which they perform. These behaviours and attitudes become information for the learner which could be perceived by observation or modelling and explain human behaviour in the view of cognitive, behavioural and environmental influence. According to social learning theory of Bandura, there are certain necessary conditions for modelling (knowledge based learning theories, 2010).

- Attention - With the increase or decrease in intensity of attention, various factors can be changed.

- Retention –This is the act of remembering what you paid attention to. This includes symbolic coding, mental images, cognitive organisation, symbolic rehearsal and motor rehearsal.

- Reproduction—Physical capabilities and self observation work for reproduction of images.

- Motivation—Motivation includes past experiences, future benefits and certain incidents which are highlighted in observation.

The social learning theory of Bandura is related to the social development theory of Vygotsk’s and the situated learning theory of Lave’s (knowledge based learning theories, 2010). All these theories deal with learning which comes with information (from whatever source it comes) and the mind processes on that information but only grasps the information that one wants. This grasping of information depends on one's intelligence and conceptualisation, finally becomes the part of memory.
3.5.2 Cognitive learning model

Grow (1996), presented a cognitive learning model in which he showed how learning could be acquired through different steps. How new knowledge incorporates with previous knowledge and which factors influence on the retrieval of previous knowledge, allowing new knowledge to be incorporated.

![Cognitive Learning Model Diagram]

Figure 6: Cognitive Learning Model

When new information emerges, the learner does not immediately start reading but learner first checks, takes an impression and tries to conceive the meaning of passages. The reader predicts about the passage, relating it to previous knowledge. If reading material is organised in a way that helps cognitive skills to relate the previous knowledge, then learning become interesting. So
strategies play an important role in improving meta-cognitive skill. The researcher has used the word comprehension because comprehension depends on the reader’s prior knowledge and strategies. Comprehension does not mean full learning. Cognitivists argue that new knowledge can be learned by linking prior knowledge to new knowledge. Researchers argue that students can convert comprehensive information to learning information though notes, minutes and summarising etc. When new information becomes part of old information, then learning takes place. This summarisation makes knowledge meaningful, useful and fits into existing knowledge network. People do not remember all the things in statements, but the memory acts like a multidimensional hypertext in which the elements are interlinked and analysed in categories and creates relations to organised schemes. People do not recall when they read but they reconstruct what they know. A well organised knowledge enables you to reconstruct and recalls what information you already know and allows new information to make retrieval of previous knowledge which you already have learned. People create solid mental constructs when they experience the things and acquire knowledge with that, as compared to that what they have just seen. So information presentation styles also influence the acquisition of knowledge.

### 3.5.3 Learning Pyramid

According to Abraham (2010), theories of multiple intelligence and learning styles argue for many ways of learning. He claims that children having different kinds of intelligence enjoy different kinds of learning e.g. children having spatial intelligence like to think in images and pictures. National training library suggested a learning pyramid for training, education and institutional strategies.

![Learning Pyramid](image)

Source: National Training Laboratories, Bethel, Maine

Figure 7: Learning Pyramid Source National Training Laboratories, Betal, Mine
Although Learning is related to intelligence, it is however, closely related to the ways through which information is delivered. Normally learning through vision is more powerful and the level of understanding is high. Evaluating the learning pyramid, it is evident that lectures and reading has a lower percentage score than audio/video learning. In this modern era it is not difficult to have audio/video learning environments. When we talk about the e-learning we have acquired 50% of pyramid values. E-learning is providing us lectures, reading, audiovisual, demonstration and discussion. Psychology also plays an integral part of the acquisition of knowledge with the support of technology.
3.6 Psychology for technology

What role psychology can perform for the use of technology and how different school of thoughts support the use of technology of learning has been delineated in this chapter?

3.6.1 Psychology

According to Friesen, (2009), “Psychology refers to systematic study of mental processes, behaviour and human activity”. Instructional design and instructional technology are considered to be the disciplinary predecessor of E-learning (Friesen, 2009). Both the fields have roots in psychology as an argument by Friesen (2009), that instructional design is originated by educational psychology, which is related to applied educational psychology whether behaviour or cognitive. According to Friesen (2009), cognitive and behaviour theory provide support to instructional design and educational technology but with respect to E-learning constructivism must be added. All three theories provide ways of understanding “the role and values of technologies in learning”. All these theories provide support for technology in education and describe how technology enhances learning.

3.6.2 Behaviourism

According to Friesen (2009), behaviourism deals with the study of human and animal behaviour, “specifically in terms of environmental stimuli and related behavioural response”. Psychologists have related the behaviour theory to the technology of the telephone in the context of stimuli and response.

Watson saw that network exchange act as an appropriate model for his theory of behaviour, in which the brain receives incoming calls from the sensory system and then relayed their message to the motor system. (Hutchby, 2001, p37 cited in Friesen 2009).

This shows that mental activities have similarity to the technology in transferring a message from source to destination. “Teaching as a technology operates through the arrangement of contingency of reinforcement under which behaviours change” (Skinner 1968 cited in Friesen 2009). This shows that if the learning is acquired in a systematic way through a teaching machine, then best results can be achieved. According to Friesen (2009), Skinner argues that this kind of machine provides stimuli in the form of small chunks of information which can have support to student response. Skinner argues that “most effective control of human learning will require instrumental aid. The simple fact is that as a mere reinforcing mechanism; the teaching is out of date”. It shows that finding the systematic technological support of human learning is more effective and has the best results as compared to traditional teaching.

3.6.3 Cognitivism

According to Friesen (2009), computer processing and capabilities can provide a basis for the understanding of the mind. Cognitive is related to mental thinking and processing of
information. According to Zhou and Fong (2003), cognitive psychology analyses the mental processes behind human behavior.

*Cognitive science tends to adopt certain general basic assumptions about mind and intelligent thoughts and behaviour. These include the assumptions that the mind is (1) an information processing system (2) a representational device (3) (in some sense) a computer (Bechtel, Graham & Abrahamsen 1998 cited in Friesen, 2009)*.

A computational procedure, Representational structures and Information processing are all related to cognitive paradigm (Friesen, 2009). These three are the basic roles of E-learning. In mental processes, when information comes in the form of input then brain processes that input and gives output through some human organism. Cognitivists argue that the human brain acts like a computer. In contrast of behaviourism which provides a “set of terms” for understanding behaviour and process of learning, cognitivism provide different set of rules and instruction for teaching and learning. In cognitivism learning does not come from behavioural change which is obtained through stimuli and response condition. Learning is not achieved through stimulus and response but it is acquired in terms of changing the way information is represented and structured in the mind (Friesen 2009). In regard to teaching, Friesen (2009), shows that cognitivists argue that teaching is not “Contingent of reinforcement” but it provides support for “active processing” for the construction of mental representation and self regulation which are the part of other cognitive processes (Friesen, 2009). After the presentation of cognitive computational model and information processes, the educational researches have also changed (Friesen, 2009).

Cognitive technology has changed the whole scenario, which is why it is considered as the cognitive revolution. It has considered the computer as a human mind. A computer is a kind of cognitive technology, a cognitive tool, and a mind tool (Friesen 2009). A computer provides support in learning. “To be an effective tool for learning, it must be closely parallel to the learning process; and a computer as an information processor could hardly be better suited for this” (Friesen, 2009). Cognitive process can have a good impact from computer technology as it can enhance the learning process. Friesen (2009), says that the computer working memory interacts with the short term memory of learner. Computers provide practices, tutorials and simulation activities which support to “communicate information in a way that avoids reaching the limits of the learner’s short term memory” (Friesen, 2009). Therefore, computers help learner to acquire knowledge and make it to the part of memory.

### 3.6.4 Constructivism

Constructivism is not directly related to the tool and technology but the invention of cybernetics, who consider human and machine as a system of command and control by giving importance to constructivism (Friesen, 2009). In the sense of E-learning constructivism emphases on the construction of knowledge, it does not support the student for getting knowledge from the instructor. According to Friesen (2009), (1) in learning process knowledge is constructed and not acquired (2) the instruction process provide support to the learner not communicate knowledge. Computer and internet is providing support in knowledge construction. However, it seems that
constructivism does not provide much support in the context of E-learning but it helps in the “testing of knowledge, its representation, verification and refinement”. So the computer and internet take an important part in knowledge construction for E-learning (Friesen, 2009). And all these facilities are available with the support of information technology.
3.7 Information technology

This chapter provides the introduction to information technology, its basic components and information technology support in the field of education.

3.7.1 Information technology introduction

Technology is originated from the Greek words *tecne* and *logia*, where tecne is skill and logia is science (I. T. L. Education Solutions Limited, Itl, 2009). Technology assists human beings in solving all problems. For the development of technology, information is necessary, which is the collection of facts (I. T. L. Education Solutions Limited, Itl, 2009). With the support of technology the process of gathering information becomes fast. The combination of information and technology makes information technology (I. T. L. Education Solutions Limited, Itl, 2009).

Information technology is that technology which studies, designs, develops, tests, and distributes computers and software programs. Computers and software programs work on data and produce information (Wikipedia, 2011).

Telecommunication and computing have joined together in information technology in order to process, store and transmit information in the form of text, pictures and videos (I. T. L. Education Solutions Limited, 2009). The components of information technology are hardware, software, data, people and procedures. Information technology stores, retrieves, processes and transmits information whenever and wherever it is required. In some organisations, information technology is also known as management information systems. It is concerned with the development and improvement of certain systems which solve a variety of human problems. It uses technology-based systems and processes to enhance the efficiency and effectiveness of information and makes it more reliable for humans.

*Hardware* is the physical component of the computer like monitor, keyboard, mouse, cameras etc. The hardware cannot work independently without the software, in order to make the computer work, special kinds of software are required and these are called operating systems.

*Software* is the set of instructions in the form of a program, which controls the sequence of operations (I. T. L. Education Solutions Limited, 2009). The software function works together with the hardware.

*Data* is the raw form of concepts, facts and instructions which can be processed by human beings or machines. Gathered data can be organised in a meaningful way for communication, interpretation and processing of tasks.

*People* perform various functions of hardware and software to produce the desired outputs from IT.

Professionals in the field of IT are trying to improve the quality of life with the support of information technology. This has improved the reasoning of human beings with its remarkable
software. Currently, it is not difficult to forecast the future or retrieve data from the past. Data security, data administration, data management and data processing fall in the scope of information technology. When Information technology is integrated with communication technology, this forms information and communication technology. In this regard information technology supports communication technology to transmit information in different forms.

Information technology (IT) supports in almost every field of life. In concerns of education, its supports cannot be ignored. IT is helping teachers to change their pedagogical ways. Students can have colourful presentation slides, games and quizzes, which enhances the learning process. With the support of communication technology, its scope has greatly improved. Now, it also supports those students who cannot physically attend the classrooms. IT has socialised, marketed and popularised education by bringing the education on different social platforms like wiki, blogs, Facebook, twitter etc. It also supports learners to get knowledge just by surfing on the webs or by using search engines. Education with the support of information technology is divided into two broad categories i.e. computer based training (CBT) and web based training (WBT). Information technology is also providing support in accessing and organising learning material through virtual learning environments which are available in both computer based trainings and web based training.

**CBTs:** are dynamic learning/teaching tools which provide learning content on a computer or handheld devices (smart phone, PDAs, or others). In CBTs learning materials are delivered on CD-ROMs and not on the internet. CBTs are efficient and less time consuming as compared to the traditional educational methods. Another benefit of CBTs is that they reduce educational cost as compare to traditional printed material because learning material is available in the form of slides, videos and animations and can be distributed to a large audience with smaller cost. Learners have no need to change location as they can get an education without the physical availability of instructors (Larson, 2010).

**WBT:** In web based training, educational material is delivered through the web browser over the internet with its compatible devices e.g. PCs, laptops, notebooks, PDAs etc. As compare to CBTs, WBTs, “deliver the program in real time environments as well as real time assessments and feedback” (Larson, 2010). Emails, discussion boards, and bulletin boards have links with the WBT. It facilitates learners to come out of the boundaries of the classroom and class schedules (Steed, 1999). The most promising aspects of WBT is the availability of virtual classrooms in which students can get recorded lectures, access databases, interact with other students and can get online lectures on remote places with the support of internet.

**Virtual Learning Environments:** Weller (2007), states that Join Information Systems Committee (JISCs 2000), has defined VLE as “the components, in which learner and tutor participate in online interaction of various kinds, including online learning”. According to Weller (2007), the VLE provides support in designing of the curriculum, student tracking, providing online support to the students and teachers, and providing online communications and internet links outside the curriculum resources. VLE are also known as the Learning Management Systems (LMS) and Learning and Content Management Systems (LCMS) based on the facilities provided by them (Weller, 2007).
LMS uses internet technologies to manage interaction between users and learning resources. Learning management systems provide support on three levels:

- **Learner Level** – The learner can check his/her performance during the training, can check schedules, review and access results, check activity, check learning level, perform different functions, get access to resources and plan E-learning on their own etc.

- **Management level** - The managers or instructor can check the performance of learner, create reports, track full detail of learner, assemble and deliver learning content rapidly in the blended or virtual learning environments, create schedules, skill assessment, online sales of courses, authoring, succession management etc.

- **Administrator level** - The register learners, give authorisation to data access and functions

LCMS focuses on the development, management and publishing of content that deliver via LMS. LCMS is a multiuser environment so it helps in the creation of content which can be reused and store. It helps in the creation of library of media elements, templates, check in/checkout, assignment, completion reports quality assurance like bug tracking, reviews and approvals etc. LMS are for planning, delivering and managing learning events where as LCMS are for creating, reusing and for managing learning contents (Wikipedia, 2011). But for simplicity LMS and LCMS are considered the same. Organization and institutes purchase learning management software according to their needs and resources. All these are the components of E-learning.
3.8 E-learning

This chapter introduces what E-learning is and how it assists in acquiring knowledge within and outside the classroom. What are the impacts on E-learning with the emergence of web?

3.8.1 E-learning Basics

E-learning is considered as the “Electronic learning”. According to Friesen (2009), E-learning is a term, which takes the advantages of technologies in education and learning. Learning styles and acquisition of information have been changed with the invention of computer. The learners have become more critical towards knowledge. Computers have become an important part of the classrooms. In E-learning Systems, the information is available on different materials and platforms. Lecture materials are available on CDs, DVDs and smart devices along with audio and video orientations which lead towards easy learning. Not only the available lectures are attractive but also electronic books and latest journals are available which support the learners to understand the basic theme of knowledge.

With the emergence of network technologies, the shape of E-learning has changed tremendously. E-learning systems use the component of information and communication technology for the distribution of education. According to Friesen (2009), the information and communication technology facilitates the learners and teachers to expedite learning and teaching. Within E-learning systems the learners use the internet technologies to receive education. According to Friesen (2009), “E-learning marshals computer and network technologies to the task of education”. Friesen (2009), stated that E-learning systems provide support in conducting learning via electronic technologies specially the internet. Now the learners have the opportunity to learn in their own way. The scope of E-learning has increased significantly and different styles have also been incorporated. The education in isolation has broken up with the support of virtual learning environments which are the gift of networking and internet; learners who could not attend classes are able to study in the classroom environment. According to Friesen (2009), E-learning has “the unique ability to bring together a community of learners unrestricted by the time and place”. Students are able to talk and discuss with other fellows and teachers in real time. Web mediated learning has the ability to collect learners on the different forums of their interest. According to Friesen (2009), the distance learning is switching from technology to pedagogical based research. The learner has explored different ways of solving different problems because the computer assists in increasing the cognitive and reasoning skills of the learner. Mary and Clack emphasize on “psychological engagement between the learner and the lesson content” (Friesen, 2009). They argue that the learning content should be according to the cognitive skills of the learners, in order to improve reasoning.

Computer and web mediated learning has also supported learners to schedule their acquisition of education according to their convenience and requirement. Web mediated learning has also resolved certain threats, which were considered to be associated with computer mediated learning. According to Rosenberg, (2001, pp 42-46), learners are assured that the material they are acquiring may not be outdated because research is going on in every discipline of education; therefore it is necessary to have up-to-date information. Sometimes the size of the material is too

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big that does not fit on DVD’s or CD’s, unfortunately some of the material may be skipped hence affect the learner’s experience. Technology barrier is also a big problem for the learners who are not on the web, some software are supported by one machine and others are not, sometimes supporting software material are not installed, this thing needs to be resolved. Problems like these and many others can be overcome with the support of web technologies in education.

3.8.2 E-learning Categories

E-learning has introduced new approaches to learning and all these have become possible with the advancement of information technology and information and communication technology. According to Siemens (2004) E-learning categories are:

- **Informal Learning** The most promising aspect of learning is informal learning in which learning is acquired from environment and surrounding. When we talk about E-learning then learning from search engines (like Google), information storage tool (like Furl) and personal management tools like wikis and blogs, are in the support of informal learning. According to Siemens (2004) learning in the break room is supplementary as compare to the learning in classrooms. We can attain informal learning just by watching others, calling the help desk, trial and error or simply by interacting others during work.

- **Blended Learning** When we talk about the blended learning then appears the concept of both classroom learning and online learning. Like the materials related to class lectures are also available on the websites which supports to reduce classroom time. Discussions and communications are not just confined within the classrooms. This kind of learning uses classrooms resources as well as other learning environments.

- **Community learning** Community learning starts when learners of same beliefs share their knowledge and ideas with each other. A community is a group of people having the same school of thought. These people use certain platforms for sharing their ideas. Information technology supports them in providing this common platform.

- **Learning Networks** Learning networks are formed by communities or groups in certain fields, recourses and people. Learning networks are the basic component of personal knowledge management. They facilitate the learners to acquire adequate knowledge of their field.

- **Work-based Learning** Electronic performance support systems and work-flow learning gives information when it is actually required. In this category of E-learning the emphasis is on the context. In lots of the computer applications we can see this form of learning (context sensitive help). Work-based learning requires significant investment for resource creation and usability.
• **Fully Online Learning**: Learning which can be acquired through the internet without going to the physical classrooms is called online learning. In online learning, the learner can become the part of virtual classrooms but not a physical classroom.

### 3.8.3 IT Can Enhance E-learning

Competences of information technology are elevating constantly and many fields are incorporating IT for their progress. These competences are also opening new ways for the enhancement of E-learning. The emphasis with respect of E-learning is to improve communication, collaboration, mobility and pedagogy for improving learning. Today we are flooded with information through electronic sources; the challenge is how to present that information. The growing trend is toward the use of IT supported open source softwares for information presentation. These softwares offer the opportunities for adaptability and innovation and provide help for university portal, course management system and student portfolios (Kwan, R. Fox, R. Chan 2008). The main advantages with the use of open source softwares are the low cost of ownership, integration with campus infrastructure and security (Kwan, R. Fox, R. Chan 2008). Open source softwares are also trying to provide support for E-learning environments on mobile devices such as tablets, PDAs, Pocket PCs and WAP 2 phones, in near future handheld devices will provide tremendous facilities to educators.

Now the new trend with the support of IT is toward personal learning environments (PLE), as opposite to the learning management systems (LMS) for accommodating the needs of the students. LMS have course centric view of learning where as PLEs are learners centric. PLEs facilitate students to get maximum control on their own learning (Kwan, R. Fox, R. Chan 2008). PLE integrates Web2 technologies like Wikis, Blogs, RSS feeds, Twitter, Facebook etc. Downes (2005), describes the PLE as: “the connection of different nodes of different webs and services used by the different students. “It is not institutional or corporate application but a personal learning centre, where the content is reused and remixed according to the student's own needs and interests. It becomes, indeed, not a single application, but a collection of inter operating applications—an environment rather than a system”.

Another possibility towards learner centric education is YouTube, which engages the learner in new learning ecology. YouTube is a website which provides facility of sharing, viewing and commenting the video clip (Kwan, R. Fox, R. Chan 2008). Learning pyramid has shown that learning through videos is more powerful than the learning just by reading or taking lectures. YouTube presents different facilities like videos in segments, taking notes, rewind, replay, audio off, image off, preview, integration to background or prior to viewing, cut, focus, collaborate, post on Facebook or blog etc. (Kwan, R. Fox, R. Chan 2008).

A new emerging concept is read/write web, which can also support instructors and learners to communicate each other in a distinct way. Initially it was compulsory to have the knowledge of HTML for writing on the web and then that web page work and protocols take that web page to the internet but now it has become very easy. Read/write web is providing the facility of writing journals, sharing those journals with colleagues, filter the news without the knowledge of any code or programming (Richardson, 2008). Read/write web is empowering the learner to acquire
knowledge and construct new knowledge in a different way. It has made the learning easy and interesting. According to Richardson (2008), now students of every age are more competent than their teachers in the computer literacy, they consult internet for getting up to date information. According to Richardson (2008), the tool box of read/write web which can provide support to teachers is comprised of:

**Weblogs:** Or blogs are easily creatable and updateable websites which facilitate authors to publish instantly on internet from anywhere or any internet connection. Weblogs can be common among students and learner to share or add information.

**Wikis:** It is a collaborative workspace which allows anyone to add content or edit already published content. Teachers and students can have password protected workspaces for creating their own text boxes and resource sites.

**Real Simple Syndication (RSS):** it is a technology which helps educators to subscribe to the feeds and get updated news from their selected websites or Weblog.

**Aggregators:** feeds generated via RSS feeds are collected and organized by the aggregator.

**Social Bookmarking:** these sites help user to save web addresses of interesting contents or to save the entire page. It facilitates learners and teachers in creating subject specific shareable resources list with the help of RSS. In this way an information community can be created to which anyone can extend.

**Online photo galleries:** these galleries help to become the part of online communities of photographer for corresponding the ideas and experiences with others. Teachers and students can also share images to enhance their understanding.

**Podcasting:** creation and uploading of audio/video files is not a big deal with the support of technology. Students and teachers can create different audio/video files and share with others and also the creation of live streaming TV is very easy.

Although this list is not complete but these types of tools can provide support to teachers to communicate and collaborate learners in a more interesting way. Many other ways have also introduced with the support of information technology to enhance E-learning.

E-learning seems to be bounded for not to provide the working experiences but virtual reality has broken this concept up to some extent. According to Kwan, R. Fox, R. and Chan (2008) Virtual reality based E-learning system can improve the student’s practical abilities. Virtual reality based E-learning system provides facility to the students to enter data, access course material, make decision and interact with 3D virtual laboratory and then the system displays the result. Within the virtual laboratories students interact with 2D and 3D geometric objects and learn about machining parts. System provides process parameter for cutting tools, cutting speed, feed rate etc., allow students to learn basic machining skills (Turning, mining, drilling) before going to original practical work. Like virtual reality artificial intelligence can also expedite learning with the support of IT.
Artificial intelligence is also providing support for education by developing software which adopts teacher reasoning in solving the problems of students. Artificial intelligence can produce realistic environments to which students can interact. In those environments students interact with the agents which can effect or perceive change in stimulated environments. The intelligent agents then can communicate perceived changes in the environment back to students who then make decisions based upon their own perception of environment (E-Learning Engineering, 2006). “An expert system inside a good algebra tutor present algebra problems and approximates, how ideal student solves those problems” (Woolf, 2008). So artificial intelligence assists students like an expert teacher by providing approximates but not the whole solution of problems. Intelligent tutors provided by the artificial intelligence act like human tutors which help students in raising their scores (Woolf, 2008). With the passage of time intelligent tutors are becoming more expert because of the advances in the cognitive science and information technology and trying to acquire more capabilities of human tutor (Park Woolf). Artificial intelligence is trying to provide different ways of learning to students. The goal of artificial intelligence is to find the ways “how human emotions influence the human learning differences and the extent to which emotion cognitive ability and gender impact learning” and trying to generate “individualized, pedagogy sound, and accessible lifelong educational material” (Woolf, 2008). Different intelligent tutors have been introduced like Animal Watch Taught Arithmetic, PAT Taught Algebra, Cardiac tutor, Andes Tutor, SOPHIE, Wayang Out Post etc. So the interaction of human with computer definitely impact on the learning capabilities of human.
3.9 Human computer interaction

This chapter gives an understanding of what human computer interaction is. What concepts are related to it, and how it could enhance performance.

3.9.1 Man machine Interaction

Human computer interaction is interaction of man with machine. According to Carroll (2003) HCI is concerned with the people understanding, how they make use of the devices that incorporate or embed computation, and how the usability and usefulness of those systems can increase. HCI is concerned with designing of interfaces for computer systems and other devices, and the ease in usability. “HCI is concerned with the design, evaluation, and implementation of interactive computing system for human use” (Berg 2003). Normally HCI is considered to deal with interface designs of computer based systems like Graphical user interfaces for windows, interface designs of mobile computing, information visualizations of digital libraries, navigational techniques for virtual environments. Now the shift is towards the creation of applications for technology to support human activities, finding new possibilities for computer support and obtaining utility and usability of devices and systems. Now professionals are working in every sort of application domain, architectural drawing, high school science, web system for e-commerce etc. participatory design and ethnographical driven design are the new goals of HCI. Participatory design is “the direct involvement of user in design work”; ethnographic driven design ensures that “new technology supports work as it is practiced and not as normatively described in the procedures’”(Carroll, 2003). Human psychological knowledge can play a key role in the creation of effective human computer interaction.

3.9.2 HCI and Psychology

For increasing the interaction of human with the computer it is necessary to design the interface in a way that it makes the use of systems comfortable and enjoyable. According to Card, Moran and Newell (1983), with the help of scientific psychology we should be able to arrange interface easily, efficiently, error freely and enjoyably. During the interaction, human communicate with the machine rather than operate the machine. For increasing the interaction of human with computer interface plays a key role and increases the usability and human factor of the system. Psychological consideration should be obvious during interface design. According to Card, Moran and Newell (1983), “know the user” should be the slogan during interface design. Now computer sciences and other domains can use the knowledge of human cognition with the advancements in cognitive science and related sciences because in cognitive science man is also considered as the processor of information. According to Berg (2003) HCI also concerned with the cognitive process, how users deal with system to carry out specific tasks, “HCI concentrates on mortar perpetual and cognitive system and two types of memories i.e. working and long term”. HCI systems interact with long term, short term memories and cognitive processes of user. Cognitive learning theory also shows that human brain act like computer so memory is also divided into different aspects: “processor cycle time, memory capacity, memory decay rate, memory code type” (Berg, 2003). During learning processes human cognition also works and
knowledge become the part of short term memory and then long term memory. Systematically defined HCI can have a great impact on the education. In E-learning Systems learners have to interact with a computer, if design of system is not comfortable and usable then this could create barriers in learning. A well defined HCI design can enhance the possibilities for the growth of E-learning Systems. It is necessary to have good knowledge for the creation of HCI designs which could improve the interaction of students in E-learning environments. Study of human mind and technology artifices is an essential part of HCI. Without understanding the cognitive level, human abilities, disabilities and effects of technology on human a better HCI design cannot be formed for students. HCI is not just related to the design of systems but also with the functionality of system. Different factors like human factor, usability, and interface design are closely associated with HCI.

3.9.3 Human Factor

HCI is considered as the subset of human factor which is defined as a file by “the study of interaction between the people, computer and their work environment” (Berg 2003). The field of human factor indicates how to introduce information system to humans and make their work life easy (Berg, 2003). Different companies are trying to create the systems which can make human life easy. Diversity in the field of computers has opened many ways to work for the human factor. Berg (2003), shows that five human factors: times to learn, speed of performance, rate of error by the user, subjective satisfaction and reaction over time have been introduced. All these factors are closely related to learning. HCI is trying to work in these human factors by reducing the time to learn, improving the speed of performance, reducing the rate of error and to increase the satisfaction as a reaction.

3.9.4 Usability

Another important factor which influences HCI is usability, which shows how “a computer system is effectively manipulated by the user in performance of task” (Berg 2003). Usability checks the performance of the system. Berg (2003) shows that usability ensures that the system functions are like the manner in which it was designed i.e. “it fits the design purpose”. Performance checks for usability which evaluates interface, dialogue design and cognitive match with the user, quality of documentation and online help (Berg 2003). It shows that usability just does not focus on the interface design of the system but it also checks for other factors. It checks that the designed system is appropriate for the target user or not. The main important factor shown by Berg (2003) is that it also checks the communication ability of the system. So usability focuses on the communication process and supports organisational processes (Berg 2003). With the invention of the computer and other HCI based devices, the challenge has increased because different types of users use these systems. So according to Berg (2003) Sheidderman has introduced three usability rules: different variety of hardware and software, systems according to the skills and requirements of user, bridges the gap between the user's previous knowledge and user urge towards knowledge. In education the need is to make the systems according to the knowledge of the learner.
3.9.5 **Interface Design**

Interface design is the part of HCI and is related to input, output devices such as keyboard, mouse, screens etc (Berg 2003). A good interface design always attracts the users because in every system users first interact with the interface. Berg (2003), has suggested seven rules for good interface design: consider knowledge of the user and user environment, task structure should be simple, function should be visible, a conceptual map should be defined, constraints and limitations should be avoided, expect user errors, the function should be standardised. The use of interaction design principals can improve all the factors of human computer interaction.

3.9.6 **Interaction Design Principals**

According to Cooper, Reimann and Cronnin (2007), the principals for interaction design provide instructions for the design of products, systems and services to make them advantageous for the users. Provide guidelines for successful and ethical practice of design. These principals are divided into several levels ranging from general practices of interaction design to the specifics of interface design. So these design principals are categorized as follows:

- **Design Values**
- **Conceptual Principals**
- **Behavioural Principals**
- **Interface level Principals**

- **Design values**

These values describe the effectiveness and ethical practices of design (Cooper, Reimann, Cronnin 2007). The designer should consider the following values while designing the product, system or service:

- **Ethics**

According to Cooper Reimann, Cronnin (2007), ethical questions can arise for interaction designers of products because these products can have a direct impact on the lives of users and can have second hand effect on the other people as well. Interaction designers have to be particular about the functionality and effectiveness of the products. Sometimes users use the product comfortably but the effect of the product on others cannot be calculated easily. Therefore following ethical considerations are required for the design of the product (Cooper, Reimann, Cronnin 2007):

**Do no harm:** the product should design in a way that it does not harm anyone; possible harm could be interpersonal, psychological, physical, environmental, social and societal. These types of harm can be removed only when the designer is well aware of the audience.

**Improve human situations:** Increasing understanding, improving communications, reducing socio cultural tensions, improving equity, balancing cultural diversity etc. can improve human
situations (Cooper, Reimann, Cronnin 2007). Designers have to be well aware and critical about all defined issues during the design of product.

➢ *Purposeful*

Purposeful design is based on “understanding of user, goals and motivations” (Cooper, Reimann, Cronnin 2007). Purposeful designs not only consider the understanding of the user goal but also it acknowledges the users limitations. With Goal Directed Designs users get help where they are weak and get “empowered where they are strong” (Cooper, Reimann, Cronnin 2007).

➢ *Pragmatic Interaction design*

While designing the product it is compulsory to consider business goals, technical issues and requirements because once the product has been designed and implemented, it should be beneficial for the owners (Cooper, Reimann, Cronnin 2007).

➢ *Elegant*

According to Cooper, Reimann, Cronnin (2007), elegance is associated to “gracefulness, and restrained beauty of style” and “scientific precision, neatness and simplicity”. Both of these ideals join together and form an elegant interaction design.

• *Conceptual Principals*

According to Cooper, Reimann, Cronnin (2007), conceptual principals state “what product is and how it is fitting into the broad context of use required by its users”. While designing the product it should be considered that the user should remain in the right frame of mind. There are no universal rules for the interaction design but some strategies can make the design better:

➢ *Flow and transparency*

According to Cooper, Reimann, Cronnin (2007), “when people are able to concentrate wholeheartedly on an activity, they lose awareness of peripheral problems and distraction, this is called flow”. Flow is also considered as the “condition of deep, nearly meditative involvement”. Cooper, Reimann, Cronnin (2007) further argues that when the person is engaged in constructive activities like engineering, design development and writing, the flow can have convincing impact and make people happy. While designing the product it should be in mind that “interface is an artifact, not directly associated to the goal of the user”. Therefore the interface should be orchestrated in a way that interaction with the software should be transparent. “All element in an interface work coherently together towards a single goal” Cooper, Reimann, Cronnin (2007). The applications communicate with the user if they are designed well.

➢ *Designing harmonious interactions*
Harmonious organization is associated to the orchestration as defined by Webster; it is what we assume from interactive product. There are no universal rules for the harmonious interaction but some strategies can help in making effective interaction design:

**Follow user mental model:** Each user constructs a mental model about the product especially on how it could perform a specific task. When the user interacts with the product they create an image of the behaviour of the machine in mind.

**Less is more:** For creating effective interaction design it is admirable to have fewer elements on the user interface without reducing the capabilities of the product.

**Enable user to direct, do not force them to discuss:** Most of the people do not like to have lots of conversation with the product. People get annoyed if they have to face lots of dialogue when they interact with the product.

**Keep tool close at hand:** Most of the application because of their complexity provides set of tools for users to cover their features. The complexity could be reduced if the selection of tools and manipulation is easy, it could prevent disturbance of flow. Therefore tools should be close to hand, commonly in palettes or tool bars for the beginner and intermediate users and should be accessible on the keyboard for expert users (Cooper, Reimann, Cronnin 2007).

**Provide modeless feedback:** Different applications provide feedback in different ways, most commonly used way is to give feedback through the dialogue boxes but these dialogue boxes should not stop the flow. The best considered way is to give modeless feedback. According to Cooper, Reimann, Cronnin (2007), the “Feedback is modeless whenever information for user is built into the structure of interface and do not stop the activities and interaction”.

**Contextualize Information:** The way in which the information is represented is another way that “it can obtrude noisily into a person’s consciousness” (Cooper, Reimann, Cronnin 2007). Normally it is considered that numeric data and quantitative data interferes the person’s consciousness. So the presentation of that information should be contextualized properly.

- **Behavioural Principals**

According to Cooper, Reimann, Cronnin (2007) the products which behave like a nice person are mostly liked by the users. The users are productive with that software which acts like a supportive colleague. So there should be “working relationship among human beings and computers”.

- **Designing Considerate products**

According to Ness and Revees software should be polite but Cooper, Reimann, Cronnin (2007), has used the term considerate to the behaviour of software. Cooper, Reimann, Cronnin (2007), state that “being considerate means being concerned with the needs of others”. People can have the positive impact of the product if the interaction of product is pleasant and helpful. If the
software behaves like a considerate human being and have features that do not irritate then interaction with the product can improve automatically. If the products are orchestrated correctly then they could behave more humanly. Cooper, Reimann, Cronnin (2007), have defined the following characteristics which can make products more considerate.

*Take an interest:* The software should act like a good friend and care for the likes, dislikes and habits of the users. Cooper, Reimann, Cronnin (2007) state that “remembering the action and preferences of human is one of the best ways to create a positive experience with software enabled products”.

*Differential:* Software should have the ability to give suggestions to the users, about the mistakes, and inform them about the consequences of mistakes. But the software should not impose its opinion.

*Forthcoming:* Mostly software just give precise answers to the questions, however they do not provide related information. The software should have the characteristic of forthcoming and should provide other related information to users.

*Use common sense:* Poorly designed functions can have inappropriate functions on inappropriate places. While designing the products common sense should be used and frequently used functions and controls should be placed clearly.

*Anticipate people’s needs:* According to Cooper, Reimann, Cronnin (2007) when user peruses web pages a Web browser spends most of its time idle. It should anticipate the user needs and fulfil user needs before request. This in turn can save the user time.

*Keep you informed:* Software should not disturb the user with the little fears but it should give modeless information that matter to the user.

*Perspective:* Software should have the right perceptive and observe the activities of the user, on behalf of those observations software should provide relevant information (Cooper, Reimann, Cronnin 2007).

- **Interface Level Principals**

According to Cooper, Reimann, Cronnin (2007) “strategies for visual communication of behaviour and information” are described by interface level principals. Interface design is concerned with the visualization of data and navigation rather than interactive functions. The arrangement of elements on the interface communicates information and behaviour. All the elements like shapes, colours, size, values, orientations, texture, and positions work together and create specific meaning. Human brain has the ability to process the bulk of visual information and make sense of visual world. Visual cues help brain process information quickly and efficiently, eyes and brain work together in a split of second and create the image of information. The Interface designer should take the help of visual processing capability and design interface
in a way to communicate information more efficiently. Some principals of visual interface design are described here:

- **Use visual properties of group elements and create a clear hierarchy**

The logical sets and controls should distinguish from each other by means of shapes and colours.

*Hierarchy* of controls and data should define according to the scenarios. Hue, saturations, positions size. Values should distinguish from each other according to hierarchies.

*Relationship* should establish according to the use of functions rather than the similarities of functions. For reducing mouse movement elements should group spatially, which has to be used together. The elements should be grouped visually which has the similar function but do not have to be used together.

*Squint Test* gives the ability to test the effectiveness of hierarchy and relationship of elements.

- **Provide visual structure and flow at each level of organization**

As stated earlier that visual and behavioural elements should be grouped together, these groupings then turn into screens, views or pages. These grouping should be in a way that the user can navigate easily from one part of interface to another (Cooper, Reimann, Cronnin 2007). Different attributes helps designers to group elements and improve the functionality of the systems/products such as:

*Alignments and Grids* can help the designer to design the interface in a way that the user can experience products in organized and systematic way. Grids can increase the usability, aesthetic appeal, and efficiency of the interface.

*Logical path can* help the user to follow the interface. Logical path should be structured according to eyes movement i.e. top to bottom and left to right. A well structured logical path on behalf of eyes moment can increase the efficiency of user.

- **Use cohesive, consistent, and contextually appropriate imagery**

Icons can help to understand the interface easily but if they are executed or designed poorly then they could irritate or confuse the user. It is compulsory for the designers to understand what the program is going to communicate and how the user will perceive the interface. Understanding of user mental model can help designers for the use of textual and visual language of the interface. Users of different cultures can have different perceptions for different symbols, colours or other elements. According to Cooper, Reimann and Cronnin (2007), “Visual element should be the part of cohesive or globally applied visual language”. The elements which are related to each other should share the visual attributes such as size, position, line, weight and overall style etc.

- **Avoid visual noise and clutter**
Cooper, Reimann, Cronnin (2007) state that visual noise in an interface can distract the primary objective and could be created by “superfluous visual element”. Unnecessary dimensional elements, boxes, overuse of rules, white spaces between controls, elements to separate controls etc. can make interface overcrowded and interfere the process of information communication.

Cluttered interface tries to provide an excess of functionality in confined spaces, which in turn can create the visual interference of controls with each other. These types of overcrowded screens could increase the “cognitive load of user”, can cause “information anxiety” and can reduce the “speed, comprehension and success of user.”
3.10 Communication

This chapter gives an overview of what communication is. What is the role of communication in culture and what semiotics is in communication?

3.10.1 Semiotics in Communication

According to Fiske (2002) signs and codes are the essential part of the communication. Signs are the tools that refer to something instead of themselves. The “codes are the systems into which signs are organised, which determine how signs are related to each other”. Social relationship increases by transmitting or receiving these code/signals in the communication process. Communication is closely associated with the culture. It is basically the core of culture without which culture may die. Fiske defines communication as ‘Social interaction through messages’. There are different schools of thoughts for the communication, some consider it as the “transmission of messages” while others consider it as the “production and exchange of meaning” (Fiske, 2002). Communication is affiliated to the sending, receiving, encoding and decoding of the messages through some channels. How this communication affects the behaviour and mental state of receiver, is the apprehension of earlier school of thought. According to this school of thought, failure in communication is related the process because it is associated with efficiency and accuracy. The second school of thought is concerned, with the meaning of the text and message, the “role of text is closely associated to the culture”. According to this school of thought, the failure in communication is associated to the understanding, which could be the result of cultural differences. However, Fiske (2002) argues that “communication is the study of semiotics (the science of sign and meaning)”. According to Ess (1996), semiotics builds up the structure of experiences via signs, words, pictures and body movements etc. They generate the interpretation of the objects, which can be manipulated independent of the world or may not have a real basis in the world. Language interferes the understanding of semiotics and is closely associated to the culture. Language supports the culture, to be clear in the institutions like religion, government, armies, marriage rites, and so forth. Culture influence our lives and determine what is important and what is not, what make sense and what does not. Semiotics demonstrates the meanings, signs, conclusions, understandings which held together with tools like languages. E-learning systems provide a facility to improve the social interaction. For creating the successful E-learning environments it is compulsory to consider the process of transmission, production and exchange of meaning and the semiotics according to the cultural boundaries. According to Salerno (2008), for E-learning systems it is compulsory to consider both technical and human communication aspects. Computer mediated communications (CMC) provide support for the technological perspective, by providing facility to the learners and teachers to manage learning content, feedback, chat discussion and contribution to the news. For human perspective CMC provides support to the members to write documents jointly, create news items and build communications within communities. But semiotics also have an important part, they play the role of sense making in computer mediated communications. They are used to represent and give specific meaning to the objects.
3.10.2 Computer Mediate communication model

Maltzke’s model (Warner, 1996), was developed for the mass communication but it was later used for computer mediated communication. In this model along with the social perspective, other perspectives like communicator’s working team, communicator in organisation and public constraints are also considered. (C) is communicator, (M) is message then there is medium and then receiver (R). At receiver end model talks about receiver self image, receiver personality structure, receiver as a member of audience, receiver social environment. When receiver receives the message and gives feedback at that time, the receiver acts like a communicator. On both ends, the receiver and communicator take the image of each other. E-learning has adopted two ways of communication i.e. asynchronous and synchronous. Within asynchronous communication, the receiver and communicators can take the image of each other in the form of videos and pictures but not live online image. In the synchronous communication, the receiver and communicator can watch online live images of each other and feedback is immediate. E-learning is not confined to a single culture, so semiotics can have multiple interpretations among different cultures.

3.10.3 E-learning and semiotics

Edmundson (2007) in the context of semiotics argues that new techno-terms and icons are invented rapidly to create a new global language; this language encounters with human having the same brain function but different cultural lenses. Learner’s cultural lens and prior knowledge makes ground for the interpretations of signs and symbols of new language. Edmundson (2007) further argues cultural signs are blended into normal communicative routines and are absorbed into subconscious communication. Normally signs, symbols and representation languages are not considered during the designing of electronic courses. Learners construct their knowledge under the influence of their culture and may interpret them wrong. With the advancement in
technologies the iconic representations and metaphors (tools of semiotics) are taking recognition on grass roots among people of different cultures and languages. Semiotics has the ability to create social component with in E-learning environment and can facilitate learning to improve conceptual understanding and cognitive integration of subject matter. Familiar symbols and signs carry cultural information which helps to relate new knowledge to previous knowledge. Semiotics can also provide support to the learners to get familiarise with the technology and can provide small chunks of information. So there should be intense consideration of international and cultural boundaries for the selection of semiotics during the creation of instructional designs or technologies for E-learning systems.
3.11 Limitations for E-learning in Developing countries

This chapter provides a deep insight of the limitation for E-learning systems in developing countries.

3.11.1 Courses

According to Smith (2002), planning and production of instructional material in a systematic way is called instruction design. In the developing countries different threats are associated with the course management for E-learning systems. The courses are not designed according to the cognitive skills and knowledge level of the learner. They are managed by the experts of the other countries which are considered to develop quality courses but they may not have the idea of the knowledge level of the learners. The courses are designed in a language which is not easily understandable for the learner, in designing of courses cultural values are not considered. In Africa a project was conducted by Australia in 2000—2004, in that project the entire course was designed in Australia and delivered in Africa, finally authorities had to stop the project because students were not feeling comfortable with that project. There is the shortage of competent teachers in developing countries. In E-learning environments the designing of instruction is somewhat different from the designing of lessons in traditional classes, therefore it is better to adopt some strategies in course management for the students of developing countries.

3.11.2 Technology

Technology is the biggest limitation for implementing E-learning systems in developing countries. Infrastructure, technology access, internet access, maintenance of technology and usability are some of the barriers for knowledge transfer in developing countries (Kohn, Maier, Thalmann, n.d.). In the context of infrastructure in almost all developing countries there is a shortage of electricity and landlines are in a bad condition (Kohn, Maier, Thalmann, n.d). Lack of infrastructure is creating hurdles for the implementation of E-learning in developing countries. In some countries privatisation is creating obstacles even when the infrastructure is available. In some schools of South Africa, bills are not paid which leads to the internet being disconnected (Kohn, Maier, Thalmann, n.d). In the context of technological barrier proper hardware and software is not available, insufficient technology has therefore become a big hurdle. The proper technology is not available in the schools as well as in homes (Kohn, Maier, Thalmann, n.d). Internet without which the concept of E-learning would not be feasible is only available in the urban cities of developing countries but with poor bandwidth. “Internet is nearly absent in an e-learning case in Botswana”. (Kohn, Maier, Thalmann, n.d). Well trained people for the maintenance of E-learning systems are not available; if some problem occurs there are very few people who are able to fix the problem.
3.11.3 Culture

Culture can be defined “as the collective program of the mind that distinguishes the members of one group or category of people from another.” (Kohn, Maier, Thalmann, n.d). Culture is also creating obstacles in the implementation of E-learning, in some developing countries like Saudi Arabia, infrastructure is available and there is no problem in the acquisition of technology. The mindset of people and lack of awareness is not allowing for the growth of E-learning. Culture is “an aggregate product of the process occurring at the social, organizational and individual levels. It includes beliefs, ideas, languages, rules, procedures and norms.” (Kohn, Maier, Thalmann, n.d). The cultural background and ideas restrict females to receive adequate education and unfortunately male domination feels that education is not for women. This is the reason that’s why some developing countries with the availability of all facilities are not taking full benefits from E-learning systems. Language, local context, social context, religion have also brought limitations. According to Kohn, Maier and Thalmann (n.d), “Language is most clearly recognizable part of culture”. All the softwares and learning material are available in the English language. The people who do not have good educational background have difficulty with the English language. Mouse, computer hardware is translated as an animal in English (Kohn, Maier, Thalmann, n.d). These concepts can create communication problems. When teachers from other regions communicate in English then the students who are just familiar with the local accent do not understand those instructors. This problem is however, more rampant in synchronous environments. In asynchronous environments these problems can be solved because students can change the pace according to their need. The local context is another limitation, if people work according to their own local context then it would be a problem for them to change. For example U.S. initiatives wanted to use Linux as operating system but some people changed to the Microsoft operating system because they were not comfortable with Linux in South Africa (Kohn, Maier, Thalmann, n.d). In order to remove the local context barrier, it is necessary to have cultural understanding. (Kohn, Maier, Thalmann, n.d). Social context involves typical opinion, ideas and traditions of society (Kohn, Maier, Thalmann, n.d). Some societies have their own traditions, for example some societies feel that the media will spoil their morals, therefore they do not want to get media based learning. Interaction is another limitation for E-learning. The interaction barrier can be seen as a mixture of ideas, rules, procedures and norms (Kohn, Maier, Thalmann, n.d). Due to family and society traditions, students hesitate to interact with others; some even feel shy to interact with teachers. Religion is also creating hurdles in some societies; in Islamic society sex separation is compulsory. Islamic students sit separate by sex in classrooms (Kohn, Maier, Thalmann, n.d). Toney Beats also found that in Saudi Arabia females are not allowed to interact with males even in the same institutions. They have separate classrooms. E-learning is a new concept in which the interaction of students and teachers is very limited, therefore students are unable to understand this system and sometimes do not want to adopt it. Students also feel that the courses are designed for developed countries and they feel the courses are not suitable for them (Kohn, Maier, Thalmann, n.d). Additionally, the students perceive that these kinds of courses will not benefit them in the future.
3.11.4 Computer Literacy and awareness

Computer literacy poses a big hurdle for E-learning. Computer availability is low and many students do not know how to use it. According to Kohn, Maier, Thalmann (n.d) the computer literacy in developing countries is generally low, this is also a barrier for E-learning. For the acquisition of E-learning systems, it is necessary to have good knowledge of the computer. Unfortunately, some teachers do not know how to use computer, so they cannot teach their students with the support of computer. Most of the people in developing countries do not understand the meaning of E-learning system which causes significant problems for the adoption of E-learning.

3.12 Summary of theoretical findings

Theoretical study is an important part of the research I have tried to find the theories and material which has supported the research question and sub questions. Here is the summary of the theoretical findings according to the sub questions.

- **How can information technology be used to support learning in developing countries?**

Learning is a process through which man, animal and machine acquires information. The different schools of thoughts have a different opinion for the acquisition of learning. According to behaviour theory learning can be acquired through external stimuli. Cognitivism believes that during the learning process, the human brain acts like a computer. Social learning theory argues that learning could be acquired from others via observation, imitation and modelling. Attention, retention, reproduction and motivation are the conditions for modelling in social learning theory. Cognitive learning model illustrates different steps for learning and portrays how new knowledge can become part of old knowledge and what could be the impact of organised knowledge in the action of learning. The learning pyramid presents different sources for the presentation of knowledge and illustrates which source has supplementary impact than the other. The learning pyramid shows that learning through audio and video sources has more points than simple lectures and readings (See chapter 3.5). E-learning, which is available with the support of information and communication technology supports learning through audio video sources along with reading and lectures (See chapter 3.8).

Psychology which is the study of mental processes, is associated with instructional design and instructional technology which are disciplinary predecessors of E-learning or electronic learning. Behaviourism and cognitivism are associated with learning but for E-learning the additional school of thought is constructionism. The different schools of thoughts have different consideration for the acquisition of knowledge but they affirm that technology supports the learning process. Psychologists have related the technology of telephone to the theory of behaviourism. A teaching machine was introduced by behaviourists. That machine has provided information in small chunks that created stimuli on which a student respond. On the other hand, cognitivists argue that the human brain acts like a computer. According to cognitivism learning is not attained through stimuli and responses but it relies on the way in which information is presented and mapped in mind. Cognitivists have presented cognitive computational model for
information processes. A computer is considered as a cognitive technology, a cognitive tool or a mind tool. Cognitivists have related the computer to the mind that is the reason they argue that the computer supports learning. Therefore cognitive process can have a positive impact of the computer and it can improve the learning process. Constructionism does not directly support the use of the computer for learning but it emphasis on the construction of knowledge. Computer and internet can support the learner in the construction of knowledge by surfing on different sites and using search engines instead of getting knowledge in the form of instructions (See chapter 3.6).

The computer amplifies the learning process as proved by psychologist; therefore it provides variant styles for the acquisition of learning. Computer based training are available with the help of different software, CDs, DVDs, LAN or internet, whereas the web based training are available on the internet with the support of virtual learning environments in which students can interact with the other students and teachers within asynchronous and synchronous mode. These virtual learning environments also provide learning management systems, learning and content management systems along with many other facilities to the learners. Most promising aspect of information technology for learners is the availability of the virtual classrooms, in which learners can get information/and education even in remote areas. Information technology is also providing virtual classes in which learners can get education in remote areas from teachers anywhere in the world. (See Chapter 3.7).

E-learning which spreads education through information technology has broken the concept of getting education in isolation; now the learners can interact with other learners all over the world. It is also providing different social platforms for making learning enjoyable and interesting. Diversity of E-learning has introduced different categories i.e. informal learning, blended learning, work based learning, community based learning, fully online learning etc. These categories facilitate learners to acquire knowledge according to their choice. Information technology with its advancements is introducing different ways for the amplification of E-learning. Open source and student centric software has been introduced. New ideas of different audio video supported website and read write webs have also announced, virtual reality and artificial intelligence are also taking part for the advancement of E-learning (See Chapter 3.8).

Learners of the developing countries are facing different challenges for acquiring knowledge and getting an education. The best part is that information technology can offer different platforms for the learners of developing countries to overcome these challenges, especially where there is the deficiency of teachers. Learners of developing countries can get an education easily from the best teachers of the world and can interact with them as they can interact with the teachers of traditional classes. Information technology based learning or E-learning is divided into different categories i.e. informal learning, blended learning, work based learning, community based learning etc. which is another encouraging threshold for the learners in the developing countries.

- **What important design principles can be used to create a more efficient HCI for e-learning?**

Human computer interaction is the interaction of human with machine. HCI is basically associated with people’s understanding, how they make use of devices or computer systems. HCI is not only associated with the interface design of the products but it is also closely associated to
the human factor and usability of the system. Professionals in the field of HCI are trying to create participatory design and ethnographic driven design of the systems, for enhancing the possibilities that design and technology work together more effectively. Psychological consideration of the users can play a key role in increasing the interaction of human and system. System influences on the human cognition during the interaction, so the use of knowledge related to human cognition can help in creating the competent HCI designs. HCI deals with human cognition, long-term and short-term memories during the interaction. Cognitive learning theory also describes that the human brain acts like a computer during the learning process, therefore systematically defined HCI can have enormous impact on the learning process. Different factors like human factor, usability, and interface design are closely associated with the human computer interaction, the possibilities of learning and interaction can be increased by paying attention to these factors (See Chapter 3.9).

Human factor which is the subfield of HCI describes how information systems can make human life easy. Five factors like time to learn, speed of performance, rate of error by the user, subjective satisfaction and reaction over time are closely associated with the human factors. Usability is the functionality and performance of the system/product. Performance of system/product can be measured by checking the cognitive match of user with product, interface design dialogue and quality of documentation and help. Rules such as a different variety of hardware and software, systems according to the skills and requirements of user, bridges the gap between the user’s previous knowledge and user’s urge towards new knowledge can help to measure the usability of the system. Interface design is most imperative factor of HCI because it deals with input, output and visualization of the system. Different rules such as: knowledge of user, user environment, and visibility of functions, constraints and limitations, standardization of the functions can help to measure the quality of the interface design (See Chapter 3.9).

HCI is a diverse field so no universal rules can be defined for increasing the efficiency of the human factor, usability and interface design but the use of some interaction design principals can help to improve these factors. These principals are divided into different levels ranging from general practices of interaction design to specific interface design. Design values, conceptual principals, behavioural principles, interface level principals are the categories of design principals. Design values measure the ethical values and the effectiveness of systems. Ethical values check that the system should not have any kind of direct or indirect harm to the user or to the surrounding people. Ethical values also emphasis on the improvement of communication, reducing the socio cultural tensions, improve equity, balancing cultural diversity for improving human situation. For the designs to be effectual the design should be purposeful, which should be based on user goal, motivation, understanding and also consider the limitations of user. Design values also argue for the pragmatic designs which consider the business goals, technical issues and the requirement of the user. The systems should be elegant enough to attract its users with the beauty, style and also with the needs of design values. The conceptual principal considers the requirements of the users in a broad context and emphases that the user should remain in a right frame of mind. Flow and transparency of the system enables the people to interact with the systems wholeheartedly and forget peripheral problems. Well orchestrated flows make the people happy when they engage in the construction of activities such as engineering, design, development and writing. In order to increase the transparency of the system it is necessary to orchestrate the products harmoniously. Consideration of certain strategies like user
mental model, less is more, keep tool close to hand, provide modeless feedback and contextualize information etc. can help to create harmoniously orchestrated products. For increasing the interaction of user with the system it is compulsory that system should behave like nice human beings. Behavioural principals demand for the designing of considerate systems. These kinds of systems consider the needs of the users. Different characteristics like to take an interest, differential, forthcoming, use of common sense, anticipate people needs, keep user informed and perspective can make the systems considerate and can enhance the interaction of user and system. Interface designs are concerned with the visualization of data and navigation but not with the functionality of the system. Elements of interface help to communicate information and behaviour. Human brain and eyes work together and map the image of the information. Therefore, it is important to consider some principals while designing the interface to communicate accurate information. Most common principals for visual interface design are: use visual properties to group elements and create a clear hierarchy, provide visual structure and flow at each level of organization, use cohesive or consistent and contextually appropriate imagery, avoid visual noise and clutter. These principles give instruction to the designer how to use elements such as shapes, size, colours, positions, orientation and how to create navigations for the use of systems (See Chapter 3.9).

Within E-learning systems learners have to interact with the computer all the time so it is compulsory to have a system which attracts its users with well defined interfaces design along with the best usability to improve the human factor. Consideration of interaction design principal during the design of E-learning systems can improve all above defined factors.

- How can information technology be used to improve communication for e-learning in developing countries?

Communication involves the sharing of ideas, information, signals and messages by talk, gesture or writings. Signals and codes are the essential part of the communication. Social relations increase by transmitting and receiving the signals and codes in the communication process. The growth of culture is closely associated with communication. Communication is the social interaction through messages. During the communication process the messages are encoded, transmitted, received and decoded and the mental state of receiver gets the influence of these messages. Culture can have ample impact on the people understanding in communication process. Communication is also considered as the study of semiotics i.e. the science of signs and meanings. E-learning is the system in which social interaction improves by transmitting messages within the same or different cultures. Within E-learning systems both technical and human communications aspects are considered. Computer mediated communications provide support to both technical and human communication aspects but semiotics also have an important part in computer mediated communications. They are used to represent the objects for sense making. (See chapter 3.10).

Maltzke’s has defined a mass communication model which considers the communicator self image, personality, organization, social environment, pressure and constraints. This model also talks about the message and the medium through which message can be delivered. The receiver side provides self image, personality structure, member of the audience and social environment of the receiver. Feedback from the side of receiver is also discussed. Computer mediated
communications provide asynchronous and synchronous communications for the E-learning systems. In asynchronous communications teachers and students can communicate via email, discussion board, and shared websites. Synchronous communications provide facility to the teachers and learners to communicate live through video conferencing or shared classrooms. E-learning is a system through which education can be delivered to different cultures. So semiotics used in E-learning systems can be viewed differently among different cultures although having the same brain functionality of all the humans. Some of the semiotics has taken the international recognition but still there is need to take care of the cultures while designing the technology and instructions for E-learning systems. (See chapter on 3.10).

Culture is closely associated to communication; culture creates barriers to the ways of communication because of having specific, ideas, beliefs, procedures and norms. Developing countries have their own cultures distinct from each other. E-learning systems do not have geographical barriers; they can communicate information from one culture to another. Unfortunately, sometimes cultures create barriers in the way of communication (See Chapter 3.11). Information technologies with its subfields have the ability to overcome the cultural barrier in the way E-learning systems.

- **How can information technology be used to increase the possibilities and reduce the limitations for e-learning in developing countries?**

Courses, technology, culture and lack of computer literacy are the basic limitations for E-learning in developing countries. Courses are not designed according to cognitive skills of learners, old or outdated courses may delivered through E-learning systems, cultural values are not considered during the design of courses are the threats which are associated with the courses in developing countries. Technology is another gigantic barrier in the mode of E-learning. Technology is associated with infrastructure, technological access, maintenance of technology and usability. Most of the developing countries are accosting the problem of lack of infrastructure for E-learning because of shortage of electricity and bad conditioned landlines. Proper hardware and software are not available to the learners in developing countries which is also creating an obstacle in the way of E-learning. Less availability of maintenance staff or the staff is not available after the installation of E-learning equipment is also a giant setback for the growth of E-learning. Another important limitation in the way of E-learning is culture, which with its beliefs, ideas, language, rules, procedure and norms interfere with the growth of E-learning. Lack of computer literacy and awareness has given birth to certain threats with respect to the E-learning. The people, who do not have the knowledge of E-learning systems, cannot appreciate its advancements. (See Chapter 3.11) Information technology and its subfields have abilities to reduce the limitation for E-learning systems in developing countries.

Information and technology has joined together to solve the problems of human being. The basic components of IT are hardware, software, data and people who join together and produce/design different systems, software and products which are helping human being in every sector of life. The services of information technology in the field of education are immense. Computer based training and web based training are two basic modes through which information technology is providing support in the field of education. IT is not just supporting in delivering the education but also it is providing support in arranging and organizing the learning contents in virtual
learning environments. Tracking students recodes, measure student performance, activity checking, delivery of learning content and many other different functions are the element of virtual learning environments (See Chapter 3.7). The education which is provided electronically with the assistance of information and communication technology is called E-learning.

For increasing the possibilities of E-learning, lots of categories of E-learning systems has been introduced with the support of information and communication technology such as: informal learning, blended learning, community learning, work based learning and fully online learning. Incorporation of web based technologies with E-learning Systems have resolved many threats which were associated with simple computer based trainings, this is also a step forward towards the possibilities of E-learning Systems (See Chapter 3.8). Reinforcement of other fields like human computer interaction and communication also participates in increasing the possibilities of E-learning.

Human factor, Usability and Interface design are three basic factors, whose advancement can improve human computer interaction which in turn can raise the possibilities of E-learning. Human factor talks about facilitating the human being with the support of information and communication technology, and the factors like time to learn, speed of performance, rate of error by the user, subjective satisfaction and reactions over time are also the compulsory factors for the enhancement of E-learning. Usability which is associated with the performance of the systems also checks the communication ability of the system. If the system is designed for E-learning then usability checks are essential because the users of E-learning Systems have distinct cognitive level. Within E-learning systems the users are students, so appropriate interface design according to the student's knowledge and cultural values is the crucial need for the progress of E-learning systems. Rules for interface design such as consideration of user and user environment, simplicity of task structure, visibility of functions, minimization of constraints and limitations, standardization of functions etc. can help to design the best interface for E-learning systems (See Chapter 3.9).

Another significantly influential factor towards the possibilities of e-learning systems is communication. Sharing of ideas, thoughts, messages and signals through some medium is communication. Social interaction increases with the communication process, this social interaction impacts on the culture which is also a big limitation for E-learning systems. For the success of E-learning systems it is compulsory to consider the process of transmission of messages, their meanings and semiotics because different cultures can be the part of E-learning systems. Computer mediated communications are used for transmission of messages and provide support in technical and human communication aspect. Technology is another limitation for E-learning systems so the accuracy of computer mediated communications also impact on the possibilities of E-learning systems (See Chapter 3.10).

Information technology is advancing day by day and creating new opportunities for enhancing E-learning. IT supported open source software generally provides help for the university portals, course management systems and students portfolios. The best part of this software is the provision of low cost ownership, integration with campus infrastructure and security. Personal learning environments are empowering students and providing learner centric environments according to the needs of learners. Many websites like YouTube are also expediting learning
with different facilities. Another emerging concept for increasing the possibilities of E-learning is read/write web facilities. Weblogs, Wikis, RSS feeds, Aggregators, Social bookmarking, online photo galleries, podcasting etc. are available with the support of information technology, for helping the learner to communicate instructors or other students in a distinct way (See Chapter 3.8).

3.13 Argument for empirical survey

After getting the theoretical information there is a need to validate this information and understand the current situation of E-learning in the developing countries. So interviews have been done for empirical survey. All the interviews were conducted through the use of web technology software like yahoo messenger and Skype. The questions for interviews were delivered through email. Initially, it was very tough to find people for interviews because I have to conduct interviews in the developing countries. I mailed to lots of colleges and universities in developing countries and received no response but after that I got some responses and conducted interviews with them.
4 EMPIRICAL SURVEY

This chapter consists of the details of the empirical survey.

4.1 Purpose

The purpose of the interviews is to verify the aspects that I found during theoretical study. This will create a comprehensive insight in how E-learning is already working in developing countries and which problems E-learning is facing.

4.2 Sampling

For my interviews I have selected two teachers and one student from developing countries. First interview was conducted with a teacher from Pakistan, she knows about the E-learning system but she is not associated with formal E-learning Systems. A second interview was conducted with a student who has studied in E-learning environment in Pakistan. And third interview was conducted with a teacher from Saudi Arabia who is teaching in a blended learning environment.

4.3 The interviews

Interview with the Pakistani student was conducted face to face; two other interviews were conducted on Skype through internet in voice conversation mode.

4.3.1 Interview

During the preparation of interview it was necessary to have good knowledge of E-learning systems so I studied books, literatures, checked the indexes for the literacy rate about the condition of ICT and Status of E-learning in developing countries. Thereafter, I contacted several people in order to interview them, because my research is related to developing countries so it was necessary to have interviewees from the developing countries. I contacted students and teachers of developing countries. Meanwhile, I prepared close and open ended questions for my interview. Many of the questions arose during the interview. After preparing the questions I sought assistance from a friend to test the questions before going for the interview and consequently altered some questions. I tried to make the questions clear without any ambiguity. Before starting the interview I introduced myself to the interviewees and then elaborated my purpose for the interview. All the interviews were recorded; I took minutes on my notebook.
4.4 The first interview

My first interviewee is teaching in the National Textile University, Faisalabad, Pakistan science 2000 as a lecturer in the Department of Management sciences as well as studying at COMSATS Institute of Information Technology, Lahore doing her Ms in management sciences. She is using the internet in her studies and for preparing lectures but she is however not the part of formal E-learning environment. After the introduction, I started formal interview.

First I presented her the questions and after that I started the interview in the form of discussion. In the context of limitation, she said that the basic limitation is lack of finances for the support of infrastructure for E-learning, if somehow people arrange finance for the E-learning systems, they have to get the approval from many authorities and the approval process is too tough, because authorities have no knowledge about the benefits of E-learning System. Other people who can get maximum benefits of E-learning are still in the dark. Unfortunately, the facility of internet is only available in urban areas, in rural areas if people try to get the internet then they have the big issue of connectivity, signals and speed. The people who have the knowledge do not like to share their knowledge; if they communicate its advantages to others then E-learning will progress rapidly in developing countries. In the context of possibilities she said that if people work diligently then many possibilities will be increased. People who are aware of E-learning systems will welcome E-learning systems. Especially the students who want to grasp new knowledge.

For increasing the possibilities of E-learning, she said that it is necessary to have the training of E-learning systems in the education sector first and then impart that training to others but the courses should be according to the skills of the learners, readymade old courses should not be delivered to them. Certain threats like unemployment, lack of competency in technology are associated with E-learning systems should be removed by providing the knowledge about the benefits of E-learning system. People will not work properly in the field of E-learning systems, if there are no proper checks and balances for the implementation of E-learning systems. So authorities should make strategies after trainings in order to check how people in this sector are working for the growth and progress of the system. In the developing countries, teachers do not have proper knowledge of E-learning that’s why they feel stressed and confused on the use of this system. Systems should be designed in a way that they feel comfortable in using them because in this way E-learning will be appealing. For the progress of E-learning systems motivation is the basic requirement if there will be strategies that will create motivation toward E-learning systems there will be constructive change.

4.5 The second interview

The second interviewee has done his bachelors from the Virtual University of Pakistan and is currently studying in one of the universities in Sweden. I selected this interviewee because I want to know what problem he had faced and what potentials of E-learning he has seen during his studies. The Interviewee was very happy with the education system at the University, although there were some problems in the system. He said that E-learning is the best system for study because one can learn according to his own pace. He also said that if any student is weak in education and has hesitation to ask questions, in this system he/she can repeat the lectures
according to his/her need, which is the best part of the system. The Interviewee showed the learning management system which he was using during his education and elaborated about the system.

The interviewee has studied at Virtual University of Pakistan. First Pakistani E-learning University based on modern information and communication technology, established in 2002. It is a rapidly growing university in Pakistan serving students within and outside the country. The learning management system which the university is using was prepared by intraLearn Software Corporation. LMS is providing support to interact with the system. The virtual university is providing asynchronous education, with which students have videos of lectures at home and in the university. It has developed campuses, where students can come from morning till late night and can use computers in the labs. The classrooms are also provided but in those classrooms teachers do not come physically, the lectures are delivered on the computers or TV. Students gather there at a specific time like most other universities and attend lectures. This facility is basically for those students who do not have internet or a computer. There is not only a main campus but lots of regional campuses in different cities of Pakistan that have been constructed. The students can learn at home but during the exam they have to go to the regional campus, at the time of exam. They are not allowed to use their own computers during exam.

Moreover, the interviewee stated that when a student was enrolled in the course, all the learning material was available before every lecture in the form of slides and lectures. Recorded videos were delivered according to the schedule. After each lecture, the discussion board was used to open. The students could post questions on the discussion board and teachers used to answer those questions and other students could participate in the discussion, this thing also helped in learning and understanding. Online assignments and quizzes were also available. Students had an option to set their date sheet for the exam because all exams were online only in the regional campuses. For the exams, students have to go to the regional campuses or the main campus. It was compulsory to use university computers in which exam software was already installed. During the exam, the timer used to start and word or PowerPoint opened if required. Availability and use of other software was not allowed at that time. The results were delivered in the student login. Chatting facility was also available to the students in LMS. Another facility which was provided to students was the purchase of books or other learning material. Initially the university was delivering that material or books at students homes, free of cost. But with the passage of time the university changed the criteria and students has to pay for the delivery charges of material. The interviewee also told me about the facilities which the university was providing. Because in developing countries like Pakistan there is rampant electricity crisis so the university was providing UPS and generators in all campuses. Initially the university was telecasting lectures on national TV channel but if there was some disaster coverage or any other event coverage on the national TV channel they skip the lectures. This was a big problem for the students who were just attending lectures on TV. Now the university is providing its four own TV channels and radio channels to the students. The university has also provided cable TV channels and created different infrastructure for cable operations, if any cable operator creates some problems then students can complain about that cable operator.

The limitations which the interviewee felt during studies were e.g. during lectures there was no interaction with the teachers although discussion boards used to open after each lecture but
answers came with delays. Normally assistant teachers were answering the students’ not the original teachers because original teachers were coming only for recording of lectures. Although the quality of lectures was very good but sometimes the university used old lectures. The interviewee is from the field of computer science that’s why he said that technology is changing every day so it is necessary to update lectures regularly. He also said that if he studied at home in front of his computer then sometimes he felt sleepy and got bored by watching computer, self motivation is required to study at home and also internet speed was not good at home. If he went to the campus, university management just turn on the TV or computer, start lecture and left the students, during the lectures some students used to start talking and created disturbance. No teleconferencing was available. There were some flaws in the chatting software and also some students misuse that software. Java scripting was not handled in that and student used to insert java script in group chat, after some intervals chatting software used to refresh itself and all java scripts run again and again. There was no facility to write blogs or make e-portfolio. There were also some security flaws within the software, students can hack others records easily, specially the results. No international collaboration was available within the system and no parental reports were arranged. In the context of strategies, he said that all education should be fully funded by the government. He felt that the attitude of society is not good towards E-learning and that it should be changed. When he applied for job, he faced bad attitude of the employer. He said some people want to donate but because of fear of corruption they do not trust, therefore education should be made corruption free. The problem of internet should be solved. E-learning systems should be implemented with proper strategies.

It was a comprehensive interview with whom I explored lots of other problems and found out new possibilities.

4.6 The Third Interview

The third interviewee is a teacher teaching in Imam Muhammad bin Saud University, Riyadh, Saudi Arabia as assistant professor, in a blended learning environment. First he elaborated the whole system which his university is using for the E-learning system. He said the university is equipped with very good resources for E-learning System. Every type of multimedia, best learning management system and very good internet speed is available. University management is also very supportive to the teachers and students. The university is divided into two campuses, one is a boys’ campus and the other is a girls’ campus. A big studio room with all modern equipments is available in boy's campus. In the girls campus there is a big multimedia screen. Girls are not allowed to meet the male teachers even they are not allowed to watch them on multimedia screens. Online video conversation with male teachers is not allowed. All the lectures are live, female students are given microphones with which they can talk with the male teachers. Shared slides and Whiteboards are available; the university has its own learning management system for uploading the course materials. All over the country internet is available with good speed, universities are giving free education to the students along with scholarships. As compared to male students, female students are benefitting more from E-learning systems. The government is opening lots of universities to attract students toward education. But still there are problems for the growth of E-learning.

The availability of female qualified staff is less. Culture has become a big hurdle in this context; middle and lower class parents of the female students are not allowing them to get education.
Only upper class is allowed to get education. Culture has imposed its own values on the religion. Boys do not want to get education and they give excuses that they have to do lots of other jobs. People get married young, so they feel that they have lots of other responsibilities. For the students who want to study, their parents do not know the importance of E-learning systems and they compel them to go to traditional institutions. Another big hurdle is that English level of students is very poor even at the university level. That’s why they hesitate to acquire E-learning systems. Companies feel that learners from the E-learning system are not as many competent as the learner from traditional institutions. The students who are getting an education through E-learning systems are not well aware of its facilities, they do not write blogs, do not use social platforms provided by E-learning system. If some of them want to use social platforms like Facebook or want to write blogs then unfortunately only males are allowed and females get huge criticism. Luckily, things are changing and the government is taking bold steps.

Many distance learning universities are opening and first Co-education University has also opened. Females are trying to break the barriers of the male-dominated society and inclining towards E-learning systems for getting education. This thing will also compel boys for getting education. In this regard, E-learning will automatically increase. In the context of strategies he said in Saudi Arabia the main issue is lack of awareness and cultural barriers. Therefore awareness campaigns in support of E-learning should be initiated.

4.7 Empirical Research Results

- **How can information technology be used to support learning in developing countries?**

First interviewee is getting the support of IT for her own learning and for preparing lectures; this thing shows that information technology supports learning, also in developing countries.

Information technology supports the learning process was confirmed by the second interviewee, his enthusiasm toward the education with the support of information technology revealed his satisfaction. He affirms that information technology supports learning. E-learning systems facilitate learner to acquire knowledge according to their needs. With this students have a chance to repeat the lectures according to their requirement, this thing also solve the problem of weak and shy students to ask questions again and again from the teacher. This interviewee also showed me the learning management system which he was using during the education. The interviewee was available with learning facilities with the support of information technology and he had enjoyed those facilities. Before the start of each lecture he was available with lecture slides and lecture material and it was recommended to read the slides and lecture material before each lecture. He said this thing helped him a lot in learning and understanding the lectures.

The third interviewee who was a teacher and using modern information technology supported equipment was also satisfied with this kind of teaching method. He revealed the fact that female students are getting more benefits of E-learning systems, due to the cultural barrier they are not allowed to get an education from male teachers. And the availability of female teachers in Saudi Arabia is very less. Information technology is also supporting the students within the cultural barriers to acquire education. The girls in the female campuses are provided with the multimedia
screens, shared slides, white board and microphones to talk with the male teachers at the other campus. Internet is available to all the students to learn and construct knowledge.

- **What important design principles can be used to create a more efficient HCI for e-learning?**

Teachers and students normally do not know what the design principles are. So for getting the answer of this question I talked about the facilities and flaws of E-learning systems.

First interviewee said that in developing countries people do not have knowledge of E-learning systems that why they feel stress in using these systems. So the system should be designed in a way that they feel comfortable in using the systems and in this way the E-learning system will be appealing.

Second interview who studied with E-learning systems has shown me the whole system which he was using during education. He told that the facilities like a discussion board, set online date sheet, availability of power point and MS Word, chatting etc. were available to the students. All these elements also help to increase the interaction of students with computer. The interviewee has experienced the E-learning systems because of that he was able to talk about the flaws of the system. He mentioned that Java script was not handled within chatting software that’s why students were able to misuse that software. It has created hurdles for many other students. There were also some security flaws in the systems; students were able to hack the record of other students. Many facilities like writing blogs and making e-portfolios were not available to the students. Such kind of flaws can reduce the interaction of students with the computer.

The third interviewee criticized the culture, which is creating obstacles in increasing the interaction of student with the computer. He complained that language of E-learning system is a big hurdle for students for getting an education through this system. He further indicates that students do not know many of the facilities provided by the system, this is also the flaw of the system.

- **How can information technology be used to improve communication for e-learning in developing countries?**

Lack of communication about the advantages of E-learning is creating obstacles for E-learning. The people who have knowledge of E-learning they do not want to share their knowledge with others, was explained by first interviewee.

Information technology support communication was affirmed by the second interviewee when he said that after each lecture discussion board used to open, students and teachers were able to post questions and answers on the discussion board. Students and teachers were also able to chat with each other through the system which was provided with the support of information technology. Student was getting an education through asynchronous E-learning system which is also a facility provided by information technology. But he complained that there were some communication problems. He said that on discussion board answers used to come late and also there were some flaws with chatting software. Within asynchronous systems teachers and
students interact via email but with email many students do not understand the exact meaning this is also a communication problem. There was no international collaboration with the other students in the world having the same course through the system.

Many facilities like multimedia screens, shared slides and white board are available to the students of Saudi Arabia. These are the facilities provided by information technology to create communication between teachers and students within the cultural barriers. The third interviewee proclaimed that culture and mindset are the big barriers for the E-learning in developing countries.

- **How can information technology be used to increase the possibilities and reduce the limitations for e-learning in developing countries?**

There are heaps of limitations for E-learning in developing countries. First one is the deficiency of funds and lack of awareness about the benefits of E-learning. Second most common problem is deficiency of appropriate technology and technological awareness. There are many other problems like fear of un-employment, fear of out dated courses, language and cultural problem etc. All these limitations were explained by the first interviewee. She also discussed about the possibilities of E-learning in developing countries. She said if people work sincerely and diligently for the progress of E-learning then the possibilities are immense. There should be trainings for E-learning systems in the teaching sector and those trainings should be imparted in other sectors. Removal of threats like un-employment and awareness about the benefits of E-learning could improve the possibilities of E-learning in developing countries.

Less interaction with teachers, less motivations by systems, no teleconferencing, bad internet speed, usage of old courses, improper management, mindset of the people and companies behaviour are the limitations which the second interviewee felt during the studies through E-learning systems. For increasing the possibilities of E-learning systems he said that education should be funded by the government in developing countries and education sector should be corruption free.

The third interviewee said that the basic limitation is culture and lack of awareness in the avenue of E-learning in developing countries. Language is also a big barrier. For the increasing the possibilities of E-learning he said that government is already taking bold steps but still there is need to give awareness about the benefits of E-learning to improve its status.
5 ANALYSIS AND RESULTS

This chapter describes the analysis of theoretical findings and their validations according to the empirical survey. This chapter also elaborates results according to the questions.

5.1 Sub Question (1.1)

- How can information technology be used to support learning in developing countries?

Learning is a process through which man, animal and machines acquire knowledge. Theoretical findings have proved that technology can enhance learning. Different learning theories have defined different ways for the acquisition of knowledge. Learning pyramid also showed that learning process can be improved with the support of audio and video aid (See chapter 3.5). This fact is also proved with the help of psychology, that technology can enhance learning. Behaviourism has related mind to the technology of telephone and cognitivism has related the mind with computer and claimed that technology can help learning in different ways. Behaviourism has shown that teaching machine can provide information in small chunks and cognitivism has claimed that a computer can become a partner in the learning process. Computer working memory interacts with the short term memory of learner; computer provides practices, tutorial and simulation activities which support to communicate information in a way that avoids reaching the limits of learner’s short term memory. So computer helps learner to incorporate new knowledge to previous knowledge. (See Chapter 3.6). Further cognitivism and constructionism analysed that information technology helps in learning and knowledge construction, different websites which provide audios, videos and read/write webs can support in improving the learning capabilities.

Information technology can enhance learning was also proved by the interviewees. The first interviewee who has not taken any formal education with the support of IT but she is using the internet for the preparation of lectures and also for her own education, discloses the fact that information technology is a good partner for getting an education and improving learning. The second interviewee also confirmed that information technology supports in learning, when he said that IT allows the learners to acquire education according to the required pace. The third interviewee also affirmed by saying that the female students are getting more benefits of E-learning systems, even within the cultural boundaries and with less available female teachers.

Almost all the developing countries are facing the deficiency of quality teachers (See chapter 3.11) and there is a threat that courses may not be designed according to cognitive skills of learners as proved by first interviewee. Information technology is providing different avenues like computer based training, web based training, virtual classrooms and virtual learning environments which can resolve the problem of deficiency of teachers.

Cognitive learning model has shown that a well organized knowledge enables you to reconstruct and recall what you already know. The availability of learning and content management system
has shown that information technology can help learning (See Chapter 3.5). Student interviewee also proclaim the fact that he has the opportunity to access learning material through a learning management system in the form of slides and recorded videos before delivery of lectures, this thing helped him in knowledge reconstruction during the lectures.

Information technology has adopted different ways for the support of learning and getting education but developing countries are using few of them. Information technology has introduced many modern concepts like blogs, wikis, podcasts etc. for the knowledge construction (See chapter 3.8) but developing countries are not taking benefits of all. This fact was proved by the interviewee who was getting an education through E-learning systems and the interviewee who is teaching in E-learning environment. E-learning has provided many categories but developing countries are just getting the benefits of some. It was proved when the student interviewee said that he has no interaction with other international students having the same course. Also the E-learning teacher interviewee said that students even having powerful internet are not getting an education from any foreign universities. Theoretical findings and their conformation lead towards similar results.

**Result Sub Question (1.1):**

Information technology can enhance learning, and it has been proved but how can IT support learning in developing countries is the basic question. Information technology can support learning in different ways in developing countries:

- **Knowledge construction**

Almost all the developing countries have partially adopted the education systems with the support of information technology but they are not using its full facilities. One of the important facilities which can easily be used in the developing countries with the support of IT is *knowledge construction*. Constructionism in psychology for technology has also shown that computer and internet can help in knowledge construction. If courses design in a way that they compel students to construct their knowledge as the part of their education then this concept will improve the education level. If writing of blogs, creation of podcasts or e-portfolios, use of RSS feeds or social bookmarking, online photo galleries etc. become the part of education, then learning will enhance automatically. For the creation of these activities, the learner will consult different curricular or extracurricular resources, which will also improve learner knowledge and learner will encounter new technological advancements. The learners of developing countries are also facing the problem of modern technological advancements. This thing will also improve the interaction of students of different countries.

- **Motivations**

With the knowledge construction another important fact which is compulsory to adopt is motivation. IT can also support for the creation of motivational environments. If there is the environment of competition and reward for writing of blogs, creation of e-portfolios or podcasts then learners of the developing countries will also get the courage to compete with the
international students, this process can also support in resolving the technological gaps between the developed and developing countries.

- **Checks and Balances**

Cognitive learning model has shown that if information is in organised form then new knowledge can easily become the part of previous knowledge. If teachers or course organizers keep an eye on learner’s activities then they can get an idea of their knowledge and also they can check that they may not use the technology in the wrong way. This can be done by checking their blogs, wikis, Facebook or other IT related activities. With the perception of learner’s knowledge they can design the course according to cognitive skills of the learners, through which new knowledge can incorporate previous knowledge easily.

- **Ease of technological use**

The awareness of technology has become a big hurdle for the developing countries. In this context IT can support in a way that if the software are designed in native and international languages then they will become comfortable for their users. Most of the learners of the developing countries are not comfortable with English language. Signs, symbols, pictures are also another tool which can be used with the support of information technology to enhance technological awareness, but these signs, symbols and pictures should be used according to cultural context so that users feel comfortable and relax for using them. This can resolve the problem of deficiency of competent teachers because learners will have another teacher to whom they can consult any time anywhere. And the possibilities toward the use of computer based trainings, web based training and visual classrooms will increase.

5.2 **Sub Question (1.2)**

- **What important design principles can be used to create a more efficient HCI for e-learning?**

Human computer interaction is the interaction of man with machine. This interaction is based on human factors, usability and interface design of the system. All three factors incorporate each other and make possible the interaction of human with the computer. The malfunction of any of these factors can lead towards the reduction of interaction of human with the computer (See chapter 3.9). This was also confirmed by the student of E-learning environment, when he explained about the chatting software which was available to him with E-learning environment. He was not satisfied with the use of that software because of some usability flaws of the software. Moreover he claimed that he was not using many of the functions provided by E-learning system, this thing shows that system was not properly designed and functions were not on clear places. Psychology also plays an important role in increasing the interaction of human with the computer.

Psychological consideration of user, during the designing of computer based systems also provides support for increasing the interaction of humans with computer. These systems
influence on the human cognition during the interaction with the systems. (See chapter 3.9). This was also affirmed by the thoughts of student interviewee when he said that sometimes he felt sleepy during study in front of computer. This shows that the system was not motivating that’s why student get bored and felt sleepy. Another important fact which was declared by the student interviewee and E-learning teacher interviewee was the use of language within the E-learning systems. If the language used within the E-learning system is not according to the cognitive level of the learner then this could also reduce the interaction of computer with human. But the attention to human factors can improve human computer interaction.

Human factors aim to facilitate people with the support of technology and make human life easy (See chapter 3.9). Student interviewee claimed that with the E-learning system, he was provided with the facility to arrange his date sheet and during the exam he was able to open MS Word or PowerPoint, these kinds of facilities make students life easy and improve human factors. Ethical values from the system or user end can influence on HCI.

Ethics can play prominent roles in increasing the interaction of human with the computer (See chapter 3.9). Sometimes systems allow its users to take the advantage of the weaknesses of the system and use the system unethically. This thing in turn can harm the other users. This fact was also proved by the student interviewee who said that because of imperfection of the system students were able to check the record of other student which in turn influenced badly. Human factor which emphasis on the comfort of human with the support of technology, usability which talk about the functionality of the system and interface design is all important for increasing the interaction, they can be improved by using the interaction design principals.

Result Sub Question 1.2:

Human computer interaction is that on behalf of which the whole E-learning system can be improved with the support of important design principals. If the systems design perfectly on the principals of design values, conceptual principal and behavioural principals and their usability measure are according to the set of defined rules then the system functionality flaws can automatically be removed.

Usability and interface design can have a direct effect on the psychology of the learners. During the interaction with systems user communicate with the system rather than operate the system. User friendly designs can be created according to the cognitive level of the learner with the support of correct navigational flows and harmonious design principals. Flow should convince the user in a way that they forget peripheral problems and enjoy the system. User mental model, keep tool close to hand and modeless feedback can help in the creation of harmonious designs. Visual and behavioural elements should group together in a way that they convert into screen, views and pages and navigate from one place to another easily. Placement of elements, shapes, colours, size and position work together and create specific meaning on the interface of the system. On behalf of visual clues human brain process information quickly and efficiently, E-learning systems are designed for the learners of different level so all the above defined aspects should be according to the mental model of the learner. On interface logical sets and controls should be placed according to shapes and colours so that they create specific hierarchy. Functions should create a relationship between them and alignment of elements should be
systematic. Logical path should be designed according to eye moment so that the efficiency of the system increases.

E-learning Systems are designed for the educational purposes so consideration of some specific things on behalf of interaction design principles can also improve the quality of the Systems:

- **Reduce Cognitive Load**

Interaction of learners with the system can automatically increase, if system designs in a way that it reduces cognitive load. Instruction design according to cognitive skills of the learner, placement of content and functions according to need, soft colours, pictures signs and symbols in cultural context, harmonic navigations of system etc. can reduce the cognitive load. The use of conceptual principle whose emphasis is on the design of system according to human mental model, modeless feedback which does not disturb the flow of system, less is more means to place fewer elements on user interface and contextualise information can also ameliorate learning abilities with the reduction in cognitive load.

- **Create enjoyable systems**

The use of comics, attractive colours, new and attractive object throughout the system can increase the curiosity of the learner towards the system and system can become enjoyable. Use of social platform like Facebook, twitter, flicker etc. for educational purposes can also be the part of instruction designs and can make education enjoyable. Fun and enjoyment during the studies can also reduce the cognitive load of the learner which in turn can improve the educational skills of the learner. The use of behavioural principals which force that the system should act like friendly human being can make the system enjoyable. Designing considerate products which concern with the needs of learners, contemplation of likes and dislikes of the learners, friendly suggestion and information about forthcoming threats in modeless way can also make the system enjoyable for the learners.

- **Games inclusion**

Games as the part of education can also make the system enjoyable. Inclusion of small educational games can incline learner towards the system. In this way the interaction of the learner with the system will increase and he/she will learn a lot during play in a light way. Also the introduction to the system can be given in the form of games. But during the designing of learning games ethical values within cultural context should be considered, these games should not produce any kind of interpersonal, psychological, physical, environmental, social and societal harm. These games should improve the human situation by increasing understanding, improving communication, reducing socio cultural tension, improve equity and balance cultural diversity.

- **No Distraction**
All the games should design in a way that they should not distract the learner from educational goal. Enjoyments and games should design after deep consideration of the cognitive skills of the learners so that they enhance the meta-cognitive skills of the learners. E-learning system design should be purposeful and according to the goals of learners.

- **Experiencing Environment**

Along with the games the experiencing environments should be the part of E-learning systems. Virtual reality, artificial intelligence and different software can assist in the creation of instructions along with experiencing environments. Practice with instructions can amplify learner’s skills automatically. This thing can also increment the interaction of learners with the systems. And the problems of frustration, boring, sleepiness can resolve.

- **Rewards on achievements**

As a result of games and experiencing environments system should give some rewards and scores to the learners and open new opportunities for getting more rewards. So that learner attract toward the system. Some rewards should be from the sides of instructors and institutions also.

### 5.3 Sub Question (1.3)

- **How can information technology be used to improve communication for e-learning in developing countries?**

Although information technology is already supporting the communications for E-learning systems in developing countries but still there are deficiencies because of cultural constraints. In some of the developing countries the availability of resources is sufficient but still people are not using those resources (See Chapter 3.11). This factor was also claimed by the E-learning teacher interviewee from Saudi Arabia where all the facilities are available but still they are not allowing their female student to use synchronous communication mode for communication with male teachers. They are using asynchronous communication and partial synchronous communication mode within the cultural boundaries.

Cultures have their own ideas and values and these ideas and values influence on the views and thoughts of the people (See Chapter 3.10). This aspect approved by the third interviewee who said that it has become the part of culture that girls should not be the active participants of the social activities. The activities which are available with the support of information technology like blogs, wikis, and Facebook are just considered for the male students in Saudi Arabia.

Culture influences our lives and determines what is important, what make sense and what does not (See Chapter 3.10). On behalf of culture people perceive the thing and grade them, mind set do not allow them to understand their benefits. E-learning teacher and student interviewee affirm that mindsets and lack of awareness about the benefits of E-learning do not allow them to see E-learning as admirable education. They consider it as low graded education even within the company where the people who have educated through E-learning Systems apply for jobs.
Humans having the same brain function see the things through their cultural lens and perceive the meanings. Even they see the pictures, videos and signs according to their own cultural lens (See chapter 3.10).

Communication is closely associated with culture, without the communications, culture may die. Social relationship increases with the transmission of code and signals. (See chapter 3.10) Lack of communication or delayed communication can impact badly on the minds of receivers. This fact was proved by the student interviewee who said that late answers of the questions on discussion boards and through emails sometime created frustration. Language is most clearly recognizable part of the culture. All the learning material and software are mostly in English with which the people of developing countries are not comfortable (See Chapter 3.11). Language barrier also reduces communication; this fact was affirmed by student and E-learning teacher interviewee. Another language which is the language of signs and symbols has its own position and cultural interpretations. Normally the signs and symbol representations are not considered during the design of electronic courses; learners some time interpret them wrong (See chapter 3.11).

**Result Sub Question 1.3:**

Mostly the communication problems are because of cultural hindrances and lack of awareness of the E-learning system. Information technology can provide solutions for communication associated problems. For changing the mindset of people there should be trainings of information technology at each level within the developing countries but start should be taken from the trainings of school teachers and company managers because these two levels are in the middle and can communicate the benefits of E-learning on each level. Further these people can impart trainings to others. For making these trainings easy the use of semiotics and multilingual software can help well. Because semiotics build up the structure of experiences via signs, symbols and pictures but these should be used within the cultural context of the countries which is closely associated with language. The description of semiotics in native to international language can also reduce many communication problems and also the learning of international language will improve automatically. Semiotics within cultural context can improve the conceptual and cognitive understanding of the subject matter. Semiotics can help in knowledge construction by relating new knowledge to previous knowledge, they can also guide for technological familiarisation by providing small chunks of information. Since whole E-learning system build on computer mediated communication so it is compulsory to consider technical and human communication aspect for the success of E-learning systems. Maltzke’s has designed a model for mass communication in that model he has talked about the self images, personality structure, members and social environments at both the ends. Selection of content is also discussed but if semiotics within the cultural context becomes a compulsory part of message content then the interpretation of message at the receiver end can enhance. So the communication through E-learning system can augment if the use of semiotics for technology and instruction designs is within cultural and international boundaries.
5.4 Sub Question (1.4)

- How can information technology be used to increase the possibilities and reduce the limitations for e-learning in developing countries?

In the theoretical part of research different factors which could be the possibilities or limitation of the implementation of E-learning in the developing countries have been found.

Table 5: Factors for E-learning

<table>
<thead>
<tr>
<th>Limitations/Possibilities</th>
<th>Teacher (Pakistan)</th>
<th>Student</th>
<th>Teacher (Saudi Arabia)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finances</td>
<td>Finances are not sufficient for the implementation of E-learning.</td>
<td>Students do not have finances for the continuation of the education that’s why education should be free.</td>
<td>There is no problem of the finances for any kind of education especially for education through E-learning. Universities are also providing scholarships for education.</td>
</tr>
<tr>
<td>IT Awareness</td>
<td>People have very less IT awareness that’s why they feel stressed in the use of technology. So the availability of IT teachers is very less.</td>
<td>Students also have less technological awareness but they are willing to adopt the technological resources.</td>
<td>People have very less IT awareness and are partially willing for the adoption of IT. There is a deficiency of IT literate teachers.</td>
</tr>
<tr>
<td>Internet</td>
<td>Internet is not available in rural areas, in urban areas it is available but with low speed.</td>
<td>Internet speed was very bad at homes but in the university it was acceptable.</td>
<td>Internet speed is excellent all over the country.</td>
</tr>
<tr>
<td>Mind Set</td>
<td>The people who have technological knowledge they do not want to impart that knowledge to others.</td>
<td>People believe that education through E-learning systems is worthless.</td>
<td>Parents do not allow students for education through E-learning systems.</td>
</tr>
<tr>
<td>International Language</td>
<td>Language is creating hurdles in the way of E-learning.</td>
<td>Up to some extent the language is creating problems.</td>
<td>Language is a big obstacle on the way of E-learning.</td>
</tr>
<tr>
<td>Resources</td>
<td>Sufficient resources are not available for the implementation of E-learning.</td>
<td>Resources are less and their utilization is not proper.</td>
<td>There is no deficiency of resources but people are not getting all the benefits from those resources.</td>
</tr>
<tr>
<td>Employer</td>
<td>Employer</td>
<td>Employer</td>
<td>Employer gives preference</td>
</tr>
<tr>
<td>Attitude</td>
<td>considers that the persons who have taken education through E-learning systems are less competent.</td>
<td>to the traditionally educated person as compare to the person who has taken education through E-learning system.</td>
<td></td>
</tr>
<tr>
<td>Threats</td>
<td>People have the threat of unemployment, technology and courses, which may not be according to skills of learners.</td>
<td>Delivery of outdated courses.</td>
<td>Culture with its own ideologies is a big threat to the implementation of E-learning.</td>
</tr>
<tr>
<td>Educational Institutions</td>
<td>Some educational institutions want to implement E-learning systems. Government also wants to implement E-learning but is unable because of deficiency of funds.</td>
<td>The institutions which have partially implemented E-learning systems are trying to implement it fully functional.</td>
<td>Most of the educational institutions and government are trying to implement full functional E-learning systems.</td>
</tr>
<tr>
<td>Teachers</td>
<td>Competent teachers are less.</td>
<td>Assistant teachers answer the questions not original teachers.</td>
<td>Female teachers are very less.</td>
</tr>
</tbody>
</table>

The limitations and possibilities which are found in the theoretical studies are validated in empirical survey by three interviewees. Mostly the limitations in selected developing countries are the same because of similarities in the culture people have almost the same mind set. But Saudi Arabia is a rich country so there is no problem of resources and finances, which Pakistan is facing badly. The common obstacles which are found in both the countries are lack of information technology awareness, mind set, language barriers and employer attitude. If these problems can be blown away then possibilities of E-learning can ameliorate.

**Result Sub question 1.4:**

For increasing the possibilities of E-learning systems in developing countries with the support of IT, work on every level is required.

- **The use of different E-Learning categories**

Advancement of IT has enabled E-learning to introduce different categories like informal learning, blended learning, community learning, learning networks, work based learning and fully online learning. Developing countries normally use blended and informal learning. They
are not using other forms of learning like community learning or fully online learning as found in empirical survey. For increasing the possibilities of E-learning it is compulsory to use all the categories of E-learning. This can only be done by increasing the awareness about these categories and by increasing the interaction of human with the computer. Awareness about the benefits of E-learning can be improved with the support of different Media with proper strategies. Magazines, newspapers, TV, radio, internet and mobile can be used to introduce the eminences of E-learning.

- **Use of CBT/WBT**

Information technology has introduced different form of computer based learning such as CBT, WBT, virtual learning environments and virtual classroom. With computer based trainings the availability of internet is not required, learners can learn with the help of CDs or DVDs. In developing countries like Pakistan internet is not properly available so use of computer based training can resolve this problem. Learning materials from quality teachers could be available on CDs and DVDs, but these CDs and DVDs should be updated at regular intervals so that learners may not get the old and outdated material. Web based training which have resolved the threats of old and outdated material can be used because in urban areas of Pakistan internet is available and students have an urge toward E-learning education.

- **Virtual Class Rooms**

Developing countries are also facing the problem of competent teachers as explored in theoretical findings and empirical survey. In that concern virtual classrooms can help best because the countries like Saudi Arabia have internet at good speed all over the country. So deficiency of female teachers can be resolved with the help of virtual classrooms. Students from Saudi Arabia can get an education from any part of the world from quality teachers.

- **Use Of Open Source**

New emerging concept of E-learning is the use of open source software. Adaptability and innovations according to the university portal are available with this software. Above all these softwares provide low cost of ownership, integration with campus infrastructure and security. So the countries like Pakistan who are facing the problem of finances can adopt these softwares easily. Also these softwares are trying to provide support for mobile devices such as, PDAs, Pocket PC, WAP2 phone and handheld devices so the learners of Saudi Arabia can also use these within cultural boundaries to improve their education level.

- **LMS and PLE**

IT has introduced learning management systems through which learner and instructors can interact, the learner can get learning material and can perform different tasks. But now the trend is shifting toward personal learning environments through which learners can get maximum control of learning activities. If learners of developing countries use the personal learning environments, than they will know the ideas of other learners and improve their knowledge. This
will also resolve many problems like lack of IT awareness, lack of teachers, international collaboration and digital divide.

- **YouTube**

  YouTube can be the best partner of the learners of developing countries because it provides support for learner centric education. It offers audio/video clips with the facility of pause, play, replay, rewind, forward, cut, collaborate and post to blog or Facebook etc. If the learners of developing countries use YouTube for educational purposes, then many educational problems will be resolved because they will have audio/video demonstration. Audio/video demonstrations are better than simple readings and lectures as proved by learning pyramid. But all the above defined facilities can be adopted if the interaction of learner with a computer is maximum.

- **Interaction design**

  As stated in the theoretical part E-learning is the combination of many systems so it is compulsory to edit all its subsystems for enhancing the possibilities of E-learning. Information technology in this context can play a positive role. Advancement in human computer interaction can imply affirmative impact. If the systems design according to the interaction design principals with the consideration of design values, conceptual, behavioural and interface design principals then the interaction of learner with the computer will automatically increase, which in turn increase the possibilities of E-learning.

- **Use of Semiotics**

  Instruction designs according to learning theories, which talk about the human cognition, can play a promising role. The use of semiotics within a cultural context for instructional design and technology can make the system more communicative which can be another step towards the possibilities of e-learning. The language of signs, symbols and pictures can also enhance the technological awareness and reduce international language barrier.

- **Modern IT Tools**

  Another limitation which developing countries are also facing is the lack of resources and practicing environment and competent teachers. The limitation of the lack of practicing environments can be reduced with the support of virtual reality based software, in which the learner can get expertise virtually before applying to the real world. Artificial intelligence with the support of information technology has introduced many intelligent tutors with the reasoning of master teachers. This can resolve the problem of quality teachers in developing countries and can attract learners toward education.
6 DISCUSSION

6.1 Conclusions

The target groups who could get benefits from my research are teachers, professionals, students and researchers in the field of E-learning, information science and informatics. They will come to know that information technology has developed new components for learning. These components are different: audio, video websites like YouTube, many read/write webs like wikis, blogs, podcasts, and photo galleries. Another facility which IT provides for the promotions of E-learning systems is the use of virtual reality based software, which enables learners to get a virtual experience of the fields, which were considered to be bounded to the working experience. In virtual laboratories learns to interact with 2D and 3D geometrical objects to learn about machining parts. Artificial Intelligence with the support of IT is also trying to help the learners like master teachers by providing help in different ways. Now the need of time is that teachers in developing countries design courses in a way that they incorporate all these facilities in their courses and help learners in knowledge construction. Wikis, blogs, Podcasts, E-portfolios, use of social platforms, and virtual learning environments should be the essential segments of the courses. The use of motivational strategies can create the environment of competition which in turn compels learners for knowledge construction in different ways. The checks and balances on learner’s activities will enable teachers to apprehend the cognitive level of the learners, so that they would be able to design courses according to cognitive skills of learners. IT has provided multilingual and different auto translator software which can resolve the problem of language barrier for learning through e-learning systems in developing countries. Improvement of human computer interaction can also expand the learning possibilities through E-learning systems because the whole E-learning system relies on human computer interaction.

Human computer interaction constructs on the human factor which talks about facilitating people with IT based systems, usability which is associated with the functionality of the systems and interface design which concerns with input/output screens of the system can be improved with the interaction design principals. Design values of the systems argue for the ethical values, purposeful, pragmatic and elegant designs for the systems. Conceptual principals which demand for transparent flow and harmonious design of the system can enhance human interaction with computer. Other two important principals are behavioural and interface design principals can also aggrandize human computer interaction which in turn can increase the interaction of learner with E-learning systems. On behalf of interaction design principles, systems should be designed in a way that they reduce the cognitive load of the learner, inclusion of enjoyable designs and educational games can shrink the cognitive load, but these games and enjoyable designs should not distract the learners from their educational goals. Use of practicing environments and presentation of rewards through systems and institutions can also amplify the interaction of learners with the system. But all these initiatives should be taken within the cultural context of the developing countries. So the system can become more communicative.

Information technology is supporting communications for E-learning systems in synchronous and asynchronous ways. Developing countries are still facing communication problems through E-learning systems, the main hindrances in the way of communication through E-learning systems are culture, resources, lack of technological awareness and language. Information
technologies can resolve cultural and technological awareness problem up to some extent. The use of semiotics for the designing of E-learning systems within the cultural context can improve the technological awareness and can change the mindset of people. The language of signs, symbols and pictures can also help those learners who have the language problem and have less technological awareness. Trainings of the E-learning systems at middle level can reduce the technological barrier and aggrandize the awareness about the benefits of E-learning systems which could be a step towards the possibilities of E-learning systems.

The possibilities of E-learning systems in developing countries can be improved by strengthening its subsystems and by the campaigns about the advantages of different categories of E-learning systems. Different Medias can be used for increasing the awareness about the benefits of E-learning systems. Computer based training can empower implementation of E-learning in those areas where its possibility is less because of unavailability of internet. Web based training can resolve botheration of old and outdated courses. Now with the advancement of IT, open source softwares are available which can provide low cost of ownership and adaptability according to the university portal. The developing countries that are facing the problem of finances can use these open source software and also those developing countries which are heading toward new technologies. Learning management systems are available with E-learning environments but now emerging the trend is toward personal learning environments, learner of developing countries can avail these environments and embellish their knowledge according to their own way. YouTube can also be the partner in this regard. But augmentation on the basis of interaction design principles of human computer interaction can imply affirmative impact on the possibilities of E-learning systems. The use of semiotics within the cultural context can be a step forward towards the possibilities of E-learning systems. Practice of all these things will automatically influence the field of informatics.

6.2 Implication for Informatics

As described in chapter 1.2 E-learning systems are directly associated with the field of informatics, so the implementation of E-learning system will have direct implications in the field of informatics. The use of new information technology tools for the enrichment of knowledge construction will have direct influence on the learners of the developing countries. They will interact with the new information technology based tools and explore the new and upcoming trends in the field of informatics.

The use of interaction design principal for the human computer interaction will increment the human factor, usability and interface design, which in turn enhance the interaction of learners with E-learning systems. This interaction will facilitate learners to get acquainted to E-learning systems more easily and improve their educational skills. The use of semiotics for the designing of E-learning systems within the cultural context will also provide comfort to the learners and their communication with the system will grow automatically. The technological and language barriers will also resolve and possibilities for the E-learning system will amplify.

The use of advertisement strategies about the advantages of E-learning systems through different media can ameliorate the awareness of E-learning systems. Use of interaction design principals and semiotics for system designs will also expedite use of E-learning systems which will
automatically lead towards the possibilities of E-learning systems. Implementation of modern information technology based tools like virtual reality based software and artificial intelligence based tutors will resolve the problem of experiencing environments and lack of quality teachers in developing countries and implication of informatics will increase automatically. Therefore my research can be evaluated.

6.3 Method evaluation

Text analysis has supported me to collect relevant text for my research, although it was not an easy task, because questions related to my research were a little bit confusing. Initially, I collected data related to the previous history of E-learning and developing countries but the important factor in my main question was information technology. I started searching data for E-learning in the context of information technology, theories related to learning and E-learning. Lots of theories have been introduced for learning so it was not easy to analyse all the theories. After that I found there are three main theories behaviourism, cognitivism and constructionism associated with E-learning systems. I analysed those theories and find out how these theories are associated the technology with education.

The method used for the text analysis is Ricoeur’s mimesis. Which has described three mimesis; I have used configuration method for my text analysis which unfolds in writing of both history and literature. Although E-learning system is associated with distance learning which has stated in 1840 but the current form of E-learning is rather new and I have considered the modern E-learning system throughout my research so configuration was sufficient for my research. For the empirical survey, I have conducted interviews and then empirical research is compared with theoretical findings.

For the verification of my research I have used interview method, which was conducted with the people who have different experiences with E-learning system. I prepared questions first and presented those questions to the interviewees. These were semi structured interviews so some questions were included during the interview. During the interviews I felt that some questions were not fully defined like in question 7) are there any constraints for implementation of E-learning? I have not mentioned the constraint of culture which was already considered in theoretical study. Question 26) what problems are teachers who are the part of E-learning Systems facing? 27) What problems are students who are the part of E-learning system facing? I should have mentioned more problems in question 26 and 27 so that interviewees feel comfortable in answering. All three interviewees were very enthusiastic and replied my all the questions in a friendly environment. One interview, with the student of E-learning system, was a face to face interview and other two interviews were conducted on Skype in voice conversation mode because one interview was conducted with a teacher in Pakistan and other interview was conducted with a teacher in Saudi Arabia.

I felt that interview is the best technique for data collection because with interviews we can have in-depth knowledge. The results of my research can be evaluated by using the research strategy.
6.4 Result evaluation

For the evaluation of the results trustworthiness, conformability, dependability, credibility and transferability has been used as described in chapter 2.5.

- **Trustworthiness**

During my research I have collected data from reliable sources so trust can be placed on my research.

- **Conformability**

Oates (2006) have defined an audit trail for checking the conformability of research. The data for the research have been collected mostly from different books, journals, research papers and websites. Then this data has been analysed through Ricoeur's Mimesis method. For the empirical survey interview technique has been used and compared with theoretical findings. After that results according to research questions and their conclusion has presented.

- **Dependability**

Dependability is associated with the recording of research process and documentation. I have used the template provided by University of Boras for the documentation and presentation of my data and for referencing Harvard’s referencing system has been used.

- **Credibility**

Credibility of research deals with the reliability of the results. For the subject inquiry I have studied different learning theories, subsystems of E-learning system and the status of E-learning in developing countries. This theoretical data is also verified during the empirical survey through interviews. So the results of the research are credible.

- **Transferability**

Transferability is the ability to transfer the findings of situations to other people. I have tried to describe my research in understandable ways that it could be easily understandable to others. Thick descriptions have been used so as to reduce the uniqueness of the research and increase the generalizability.

6.5 Possibilities to generalize

My research is generalized because the data which I have selected is from reliable sources and presented in an authoritative way. I have used the standard theories with proper references and other literatures which are used also have accurate references. My research will give accurate results to target groups and will give a clear understanding. If the research is checked in validity context, than I have done interviews for the validation of my research findings.
6.6 Ideas for continued research

During my research I have studied different subsystems of the E-learning. E-learning is a broad area and information technology is diversifying day by day so many other aspects can also incorporate the research. Data clouds which are new concepts can serve E-learning systems in a different way for developing countries. E-learning can be enhanced with the support of artificial intelligence by the incorporation of games like X Box. The advancement of mobile technology can be the best partner of E-learning systems in the future.

6.7 Speculations for the future

In my research I have identified new facilities which are being provided by information technology such as audio/video and read/write web sites, if they are used properly in developing countries then the level of education will improve automatically. I have also presented the idea of virtual reality and artificial intelligence briefly in my research; if these concepts improve in the future then they can have immense effect on the growth of education. The results of my research will help in the implementation of E-learning in developing countries.
References:


Gadamer, (1960), ‘Truth and Method’. Translated From (German), by (Hans Georg Gadamer, Joel Weinsheimer, Donald G. Marshall) [E-books], Continuum International Publishing Group, 2004 - Philosophy, Available at: http://books.google.co.uk/books?id=ScG5YqYcsEcC&source=gbs_navlinks_s


I. T. L. Education Solutions Limited, Itl (2009), “Introduction to Information Technology”, [E-Book], Pearson Education India-sidor, Available at: http://books.google.co.uk/books?id=ib2MI6_B9qYC&printsec=frontcover&dq=Introduction+to+Information+Technology&hl=en&ei=W7FnTeKD8m64Qbms6HfCQ&sa=X&oi=book_result&ct=result&resnum=3&ved=0CEkQ6AEwAg#v=onepage&q&f=false, [Assessed 2010].


Lind, A. (2005), Successful Knowledge creation in Virtual Communities, Influences Factors and Driving forces: [Pdf], Högskolan i Borås: Accessed [2010].


Mahmud and Gope (2009), Challenges of Implementing E-learning for Higher education in Least Developed countries: A case study on Bangladesh, [Online], 2009 International
Conference on information and Multimedia Technology, [IEEEXplore, Hogskolan i Boras]
Available at:
http://ieeexplore.ieee.org.lib.costello.pub hb.se/stamp/stamp.jsp?tp=&arnumber=5381225,
Assessed 2010.

At:http://books.google.co.uk/books?id=efSKBrsk7UkC&printsec=frontcover&source=gbs_ge_s
ummary_r&cad=0#v=onepage&q&f=false [Accessed,2011]


Pressler, C, A., Dasilva, F, B.(1996), ‘Society and Interpretation: from Weber to Habermas’, [E-
book], SUNY Press- Social Science Available at:
http://books.google.co.uk/books?id=ujyJ4QCaX8C&printsec=frontcover&source=gbs_ge_sum-
mmary_r&cad=0#v=onepage&q&f=false :[Accesses 2010]
The Technology Source Archive, at the University of North Carolina, Available At:
http://technologysource.org/article/model_for_effectively_supporting_elearning/ ,[2010]

Rosenberg, Marc J.2001 E-learning. strategies for developing knowledge in digital age: [Book]

2006 Available at: http://www.socialresearchmethods.net/kb/dedind.php [Accessed 2010]
Richardson,W. (2008), Blogs, wikis, podcasts, and other powerful web tools for classrooms,[E-
Book] Corwin Press- Education, Available at:
http://books.google.co.uk/books?id=sRlAxsd0lcAC&printsec=frontcover&dq=Blogs,wikis,+p-
odcasts,+and+other+powerful+web+tools+for+classrooms+hl=en&ei=aLNdT-
E5K24gbQsqозCQ&sa=X&oi=book_result&ct=book-
thumbnail&resnum=1&ved=0CCsQ6wEwAA#v=onepage&q&f=false, [Accessed 2010].

interaction, [E-Book], Routledge- Computers, Available at:
http://books.google.co.uk/books?id=qU-DaL49R9EC&dq=The+psychology+of+human-
computer+interaction+source=gbs_navlinks_s, [Accessed 2010]

Sandelowski, M. (1991), Telling Stories: Narrative Approaches in Qualitative Research,
IMAGE: Journal of Nursing Scholarship, Volume number [23] Available at:
http://academic.son.wisc.edu/courses/n701/week/sandelowski_tellingstories.pdf :[Accessed
2010]

http://books.google.co.uk/books?id=3ebDRxd7mWkC&printsec=frontcover&dq=Web-


**Appendix:**

**Interview Questions**

1. Do you feel that IT can support leaning, If yes then how?
2. Which form of getting education is better?
   a. Readings
   b. Lectures
   c. Audio /Video
   d. Experiences
   e. Other__________________________________________________________
3. Do you think people have knowledge of E-leaning in your country?
4. Are people willing for implementation of E-learning system?
5. What are the basic limitations for E-learning according to your point of view in your country?
6. What are the possibilities for E-learning in your county?
7. Are there any constraints for implementation of E-learning? From
   a. Government
   b. Political constraints
   c. Private educational institutions
   d. Government educational institutions
   e. No constraints from any one
   f. Other __________________________________________________________
8. Are Educational institutes willing to adopt E-learning systems?
9. Are students willing to pay for education through E-learning system?
10. Is there sufficient man-power (teachers, system organizers, technicians) for implementing e-learning?

11. In which category man power is available in your country for implementation of E-learning system? (If answer of above question is No then leave this question).
   a. Teacher
   b. System organizers
   c. Technicians

12. Do people have access of Internet?

13. For what purpose are educational institutions using Internet?
   a. For Advertisement
   b. For performing official tasks
   c. For distributing educational material
   d. Other____________________________________________________________

14. For what purposes people using Internet?
   a. Chatting
   b. Video conferencing
   c. Getting information
   d. Web surfing
   e. For E-learning systems
   f. Other____________________________________________________________

15. Which technology students use most for getting education?
   a. Radio
   b. TV
   c. CD/DVD
   d. Intranet
   e. Internet
   f. Other____________________________________________________________

16. Are people getting education through E-learning system?
   a. All
   b. None
   c. Some
   d. Mostly

17. How is the attitude of companies for people who have acquired education through E-learning Systems?
18. Which types of E-learning services are used most frequently?
   a. Getting lectures through TV/radio
   b. Using CDs/DVDs for learning material
   c. Blended Learning (classroom learning and use Internet/Intranet for accessing material)
   d. Fully online learning (Use Internet for lectures and for accessing learning material).

19. Are students satisfied with E-learning services?

20. Which facilities of E-learning systems are available in your country?

21. Is there proper communication among teachers and students through E-learning System?
   a. Yes
   b. No
   c. Partial collaboration.

22. Is there proper communication among student and student through E-learning Systems?
   a. Yes
   b. No
   c. Partial Collaboration

23. What are the communication problems through E-learning system?
   a. Internet speed
   b. Software do not work properly
   c. Culture do not allow communication
   d. Other________________________________________________________

24. Which services of E-learning system are students using most?
   a. Getting material
   b. Uploading assignments
   c. Live lectures
   d. Chat
   e. Video conferencing
   f. Discussion board
   g. Blogs
   h. E-portfolio
   i. Collaboration with management
   j. Extracurricular activities
   k. Other _________________________________________________________

25. In which format learning material is available?
   a. Presentation slides
   b. E-books
   c. Text and audio
   d. Text and video
   e. Any other format______________________________________

[94]
26. What problems are, teachers who are the part of E-learning Systems facing?
   a. Management of course through E-learning system
   b. Poor Internet speed
   c. Teacher student collaboration problem
   d. Problem in testing skills of students
   e. Schedule organization
   f. System do not work properly
   g. Functions are not clearly defined
   h. Colours and shapes in system are not good
   i. No Problem
   j. Other Problems______________________________

27. What problems are, students who are the part of E-learning system are facing?
   a. Language problem
   b. Poor Internet speed
   c. Problem in accessing course material
   d. Collaboration problem with teachers
   e. Collaboration problem with other students
   f. Colour and shapers are not good
   g. Functions are not properly defined
   h. e-learning system is complicated to understand
   i. Cannot measure their performance
   j. No Problem
   k. Other Problems______________________________

28. What are the flaws with E-learning Systems, which you have experienced?

29. Any comment that you would like to add?
University of Borås is a modern university in the city centre. We give courses in business administration and informatics, library and information science, fashion and textiles, behavioural sciences and teacher education, engineering and health sciences.

In the School of Business and Informatics (IDA), we have focused on the students' future needs. Therefore we have created programs in which employability is a key word. Subject integration and contextualization are other important concepts. The department has a closeness, both between students and teachers as well as between industry and education.

Our courses in business administration give students the opportunity to learn more about different businesses and governments and how governance and organization of these activities take place. They may also learn about society development and organizations' adaptation to the outside world. They have the opportunity to improve their ability to analyze, develop and control activities, whether they want to engage in auditing, management or marketing.

Among our IT courses, there's always something for those who want to design the future of IT-based communications, analyze the needs and demands on organizations' information to design their content structures, integrating IT and business development, developing their ability to analyze and design business processes or focus on programming and development of good use of IT in enterprises and organizations.

The research in the school is well recognized and oriented towards professionalism as well as design and development. The overall research profile is Business-IT-Services which combine knowledge and skills in informatics as well as in business administration. The research is profession-oriented, which is reflected in the research, in many cases conducted on action research-based grounds, with businesses and government organizations at local, national and international arenas. The research design and professional orientation is manifested also in InnovationLab, which is the department's and university's unit for research-supporting system development.