Investigating role of interactivity in effectiveness of e-learning

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Abstract

In last decade or so, e-learning seems to be emerging as the dominant model of learning but questions are being raised about the trade-offs in switching from traditional classroom based learning to e-learning; for example, e-learning is cost effective, round the clock accessible and convenient but there are questions raised about its quality and effectiveness.

In last decade Saudi government has undertaken several steps for reforming the education system in the Kingdom including provision of education for all. E-learning can play a vital role in helping Saudi government reach its ambitious targets but despite its obvious benefits the overall adoption of e-learning in the Kingdom has remained low. The key problem in this regard is lo perceived effectiveness of e-learning.

E-learning is quite beneficial in that it can help individuals not only acquire knowledge but also skills which allows them to learn independently without constraints using the vast amount of education resources available online. However, the main focus of the e-learning community in the Kingdom has remained restricted to teaching specific subjects.

This research argues that the true potential of e-learning is much broader and useful than currently perceived by the e-learning community in the Kingdom. E-learning has the potential of producing lifelong learners. Hence the focus of e-learning community should be on overall skills development. This research thus defines e-learning effectiveness in terms of both short term goals (that is, learning about the subject) and long term goals (improving skills and motivations for being lifelong and independent learner).

This research investigates impact of four kinds of interactivity (Student-Student, Student-teacher, Student-content, Student-System) on effectiveness of e-learning. This is a mixed methods research. Data was collected using focus groups and questionnaire surveys.

This research finds that all four kinds of interactivity play a role in improving effectiveness of e-learning. All four kinds of interactivities were found significant for improving course learning.

Student-teacher, Student-Student and Student-Content interactivities were found critical for improving independent learning skills. Student-Student an Student-Content interactivity was found critical for improving motivation for being lifelong e-learner.

Contents

1. Introduction

1.1   Overview

Teaching/learning has been a part of human lives for centuries and will continue to be a part of human society but the field has witnessed a significant level of transformation in last few decades with introduction of e-learning being the latest (Jabli and Qahmash, 2013). There are several drivers of the e-learning initiatives including the changing student expectations and behaviour, cost cutting, quality improvement and widening participation (Jabli and Qahmash, 2013; Aljabre, 2012; Mirza and Al-Abdulkareem, 2011; Tubaishat, 2008; Allen and Seaman, 2008; Littlejohn and Pegler 2007). Modern lifestyles have made the adoption of e-learning quite easy and in some ways, obvious, and considering its benefits, it is useful to invest our efforts in improving the quality of education in e-learning model.

With rise in number of geographically independent learners and with increased adoption of technology based services adoption of e-learning is likely to increase with time. However, critics argue whether it is really beneficial in terms of learning and highlight the trade-offs that must be considered when comparing advantages and disadvantages of e-learning over traditional classroom based learning; for example, e-learning is cost effective, round the clock accessible and convenient but there are questions raised about its quality and effectiveness (Abbad, Morris and de Nahlik, 2009; Ozkan and Koseler, 2009; Selim, 2007). However, e-learning may lack interactivity and consideration for pedagogy which could makes it inferior to traditional classroom learning (Croxton, 2014; Littlejohn and Pegler 2007). Interactivity and pedagogy have a significant impact on the learning of individuals and lack of interactivity definitely creates a gap which affects the quality of learning provided through e-learning channel (Kuo, Walker, Schroder, and Belland, 2014; Croxton, 2014; Rochester and Pradel, 2008).

There has been some development in improving interactivity in e-learning but researchers have called for further improvement in interactivity in e-learning (Croxton, 2014; Kuo et al. 2014; Rochester and Pradel, 2008; Littlejohn and Pegler 2007). According to these researchers, e-

learning systems are some distance from replicating the quality of classroom learning suggesting that there are aspects of interactivity which are still missing from e-learning. These aspects are to be identified and incorporated in e-learning in order to ensure that we extract the maximum benefits of e-learning systems. This research is based on the view that content and technology alone cannot guarantee the quality of e-learning and unless all aspects of interactivity are resolved, the quality of e-learning will remain questionable.

There are two key terms in this research: interactivity and effectiveness of e-learning. These are briefly discussed below:

1.2   Interactivity in e-learning- a snapshot of the research

E-learning is growing in stature as an alternative channel of teaching and learning (Croxton, 2014). There are several reasons why e-learning is becoming popular. For example, it allows freedom of learning from anywhere, any time and to acquire advanced IT usage skills (Coleman, 2012). However, there remain concerns regarding interactivity. Past research indicates that active participation of students is critical to their success in online courses (Kuo et al. 2014; Chejlyk, 2006; Keeler, 2006) and hence it is essential to focus on improving interaction in online courses in order to increase student satisfaction and engagement in online courses (Croxton, 2014; Allan, 2008; Mandernach, 2005). Even for the systems which allow students to interact with each other, here is a lack of social bond between students which affect their willingness and motivation of mutual exchange of knowledge. Park and Bonk (2007) lists some key advantages of improving interactivity in e-learning: improves feedback, encourages exchange of diverse perspectives, enhances dynamic interaction among students, strengthens social presence, fosters emotional support exchange, and supplies verbal elements. Croxton (2014), Allan (2008) and Chou (2002) also recommend that we must look to enhance socio-emotional interactions and interpersonal connections in order to engage the learners in a way that they are done in traditional classroom environment.

Interaction has been defined differently in different contexts. In context of learning, Daniel and Marquis (1988) defined interaction as activity in which a student is in two-way contact with one or more persons. Gilbert and Moore (1998) defined interactivity in e-learning as the reciprocal exchange between the technology and the learner. However, this definition ignores the human-human interactivity and focuses solely on technology-human interaction. Most of the researchers consider interaction and interactivity to be the same, however, Wagner (1994: 6) disagrees and comments that "interaction functions as an attribute of effective instruction while interactivity functions as an attribute of instructional delivery systems." According to Wagner (1994: 9), instructional interaction is "an event that takes place between a learner and learner's environment and its purpose is to respond to the learner in a way intended to change his or her behavior toward an educational goal." Wagner's differentiation between interaction as an outcome of using interactive instructional delivery systems and interactivity as a machine attribute is widely accepted. However, Roblyer and Ekhaml (2000) argue that here is a strong relationship between the two in context of e-learning. According to them interactive technology allow student-student, student-teacher and student-system interaction.

One of the major drawbacks of why universities have not managed to adopt online channel completely is the limitations on costs and facilities. Implementing full scale online courses is quite costly for universities especially considering that it may provide limited benefit for the providers and the learners. Anderson (2003) proposed the interaction-equivalency theorem which tackles this problem to certain extent. According to the interaction-equivalency theorem, having a deep and formal learning one high level interaction is sufficient instead of designing of high level of all interactions or middle level of them. However; several researchers (e.g. Chou, 2002; Moore, 1993; Thurmond and Wambach, 2004) have argued that unless interactivity is resolved holistically, there will remain a gap between the effectiveness of in-class and online learning. As a consequence, e-learning will only be used as an aid to improve the effectiveness of in-class learning. In order to use e-learning as an alternative channel for delivering knowledge, a holistic approach to interactivity is required and hence all aspects of interactivity in e-learning should be considered.

This research will look at interactivity from a multidimensional perspective and provide recommendations on how it can be enhanced in order to enhance the overall quality of e-learning.

1.3   Effectiveness of e-learning

Mandinach (2005) recommends taking a long term view on evaluating the effectiveness of e-learning and comments that whilst it is challenging but will be definitely rewarding. One of the questions that the researcher had to consider was how to evaluate the effectiveness of e-learning. According to Patton (1986: 14) evaluation of a program involves "systematic collection of information about the activities, characteristics, and outcomes of a program for use by specific people to reduce uncertainties, improve effectiveness, and make decisions with regard to what those programs are doing and effecting." Similarly, Mertens (2009: 49) defined evaluation as "an applied inquiry process for collecting and synthesizing evidence that culminates in conclusions about the state of affairs, value, and merit, worth, significance or quality of a program, product, person, policy, proposal, or plan." In context of e-learning Phillips (2002) argue that e-learning should be evaluated on the basis of its usefulness of the students. In this regard evaluation of e-learning could be made in regard to the students because ultimately it is the students which are being affected by the whole learning process.

Effectiveness is a very commonly used yet a fuzzy term. Every project has multiple stakeholders and their view of the term may be different. In short effectiveness refers to achievement of goals. In context of e-learning, effectiveness can be defined as measure of whether the system has achieved its short and long term objectives (Reeves and Hedberg 2003). It leads to the same confusion as before. For example, the objective of e-learning for the service providers could be value-maximisation/ cost optimisation while for the students it could be to enhance their knowledge. This research considers effectiveness from the perspective of the students. Researcher believes that formal learning is a significant investment of time, money and effort for

the participants and no amount of money could compensate for the lack of quality in education. Hence the researcher believes that the first and foremost perspective when evaluating the effectiveness of any education system should be that of the learner. Hence this research looks at the term effectiveness from learner's perspective. Learners themselves may have some level of discrepancy in their expectations from e-learning; for example, some could be just looking for a certificate or some others could be using it just for the sake of convenience while some others could be using it for genuine knowledge improvement. While different individuals may have different preferences and expectations, the learning process is expected to provide students with desired knowledge. Hence the primary objective of any e-learning course is knowledge gain by the students. This is thus used as the primary measure of effectiveness in context of this research.

Reeves and Hedberg (2003) proposed looking at both short term and long term benefits of e-learning whilst evaluating its effectiveness. This research looks at effectiveness as something beyond the subject knowledge gained by the individuals; it takes a broader view and considers effectiveness from the perspective of independent learning skills. Researcher believes that e-learning has the potential of giving us the skills as well resources to learn independently which will be of great use to the human capital development of modern society.

1.4   Motivation for the research

Leung (2003) recommends that evaluation of effectiveness of e-learning at earlier stages, that is, before its large scale adoption is quite useful in order to identify its strengths and weaknesses and address them accordingly. While the researcher supports views of Leung (2003), she extends his recommendations and recommends that evaluation of effectiveness is essential in order for us to understand how to best implement it in order to maximise the benefits to the human society. Thus the researcher supports the views of Reeves and Hedberg (2003) and Sawaan (2005) that evaluation of e-learning should be aimed at developing the program i.e. identify how to design and implement it to maximise its benefits. Thus evaluation is useful only if it informs our

decision making (Stufflebeam 2001). This research thus adopts Dempster's (2008) views on evaluation who commented that evaluation is "intended to judge the quality of practice and the academic quality of teaching, to justify investment in e-learning, to develop and improve the performance of the individual packages and participants." This research is thus aimed at providing practical recommendations on how to improve the design and implementation of e-learning programs.

The current e-learning systems merely provide access to different learning environments in a mass learning system but such systems are not effective as it homogenises the learning environment despite heterogeneous behaviours and preferences of the learners (Kuo et al. 2014). The arrival of latest generation internet technology provides multiple possibilities to make the e-learning system more effective than its current format. According to Wagner, (2008: 9) "the significant role played by technology mediation, and the value that rich, engaging content creation, distribution, and management tools contribute to the e-learning experience, enables new levels of engagement and participation among all learners." However, the use of technological medium and tools for learning and teaching, or e-learning, has mainly focused on technological aspects rather than the effectiveness or efficiency of its application (Liu, Magjuka, Bonk, and Lee, 2007; Tello, 2007).

As Herrington and Herrington (2006) argue, e-learning systems should be designed so as to emphasise on situatedness which is key to implementation of authentic learning. Authentic learning elements include authentic context and activities, collaboration, reflection, access to expert performance, multiple roles and perspective, articulation and authentic assessment. Authentic context refers to the learning environment which should replicate the real life learning environment. Over centuries, humans have adapted to classroom model of learning and hence the authentic context should refer to replicating the classroom model in which the tasks and activities are loosely-defined. As mentioned under the theory of constructivism, learning is not about learning the content but learning to construct knowledge. Hence authentic learning will refer to learners' ability to construct knowledge independently. IN this context the role of the teacher will shift from being an instructor to being a facilitator of knowledge construction. Thus teachers

will have to move away from conventional exam based approach to diagnosis, reflection and self assessment. This also means that the role of the learners will also shift from being passive learners to being active learners i.e. seekers of knowledge. The current e-learning systems will fail to achieve their learning goals unless the gap between the pedagogical aspects of traditional and e-learning systems is narrowed. This can be done by improving interactivity in e-learning systems (Croxton, 2014).

While narrowing the gap between classroom and e-learning channels is an objective for improving interactivity in e-learning but e-learning can be potentially far more useful than traditional classroom model. Governments and educational institutions around the world are realising e-learning as an opportunity to become more efficient in delivery of education as well as enhance the ability to reach out to more number of learners as compared to that could be achieved through classroom model. The phenomenon of e-learning began with the internet as it allowed learners access to a wide range of learning resources which could never be achieved in classroom model. Not only the individuals have access to a wide range of resources just at the tip of their fingertips but it also provides them the freedom of selection. It was thus, logical to develop e-learning systems which will allow learners to benefit from access to wide range of resources from around the globe. However, one of the benefits of e-learning that has largely been overlooked by the designers of e-learning systems has been constructivist learning. Internet allows individuals to access information online without any barriers and in this respect it allows individuals to become independent learners. This is quite beneficial for the society as a whole because individuals can continue their learning and development independently for the rest of their lives. Often individuals, after they start working, find it difficult to return to formal education system, and e-learning provides them with an ideal chance to continue their learning ensuring that their knowledge does not become obsolete with time. E-learning has the potential of turning individuals into lifelong learners and hence allows for a cumulative growth of the society. In order to achieve constructivist learning, e-learning systems should be designed to facilitate independent learning. However, the benefits of learning through experts could not be ignored and hence e-learning systems should be designed so as to allow higher level of interaction where individuals can select from vast number of experts and exchange their

knowledge in order to enhance the overall knowledge of the participants. This would require focus on interactivity in e-learning from a different perspective. It can be argued that significance of interactivity in e-learning is even greater than that in classroom model due to the immense potential of constructivist learning that e-learning model provides. In this respect, interactions; Learner-Content, Learner-Instructor and Learner-Learner, are key to the success of e-learning projects (Croxton, 2014). According to Wagner (2008: 9), "interactions that promote and enable a strong sense of social presence help keep learners engaged and motivated," and this is essential to achieve the objectives of constructivist learning.

This research investigates how interactivity affects the effectiveness of e-learning and how interactivity can be improved in e-learning systems. This research will make a significant contribution to the current research in the field of e-learning as it looks at different aspects of interactivity in context of e-learning. This research does not focus solely on technological aspects because technology is dynamic and plays the role of enabler. Technology being dynamic the researcher believes that new technology will be developed (if not already existent) which will help us achieve whatever we wish to achieve but what is important is to know what we wish to achieve by deploying the technology. Identifying the different attributes of interaction that influences the effectiveness of e-learning will help us clearly assess our requirements which in turn will help us develop systems which will not only be cost effective and convenient but also useful for learning (Croxton, 2014).

One of the problems with existing approaches to improve interactivity in e-learning is the one-dimensional approach to interactivity (Allan, 2008). While most approaches tend to focus on improving learner-instructor interactivity, there are other dimensions of interactivity which have been largely overlooked. For example, Chou (2002) and Rhode (2007) draw attention towards lack of socio-emotional interactions which enhance interpersonal connections. According to Chou, in e-learning system, the user experiences two kinds of interactions; technical and non-technical. Rhode (2007) categorises interaction in e-learning in two categories- formal interaction that is built into the curriculum design and informal interaction which occurs in

addition to the e-learning course. Researchers (example, Croxton, 2014; Chejlyk, 2006; Keeler, 2006) identified three types of interaction inherent in effective online courses: 1) learner-to-content interaction, 2) learner-to-instructor interaction, and 3) learner-to learner interaction. Here Learner-content interaction refers to how interactively the learner can engage with the content in order to alter the understanding, perspectives, and cognitive structures of his/her mind. Learner-instructor interaction refers to the extent to which the teacher is able to intellectually stimulate the mind of the learner in order to generate a motivation to learn. Learner-learner interaction refers to the extent to which the learners are able to socially communicate with the peers in order to exchange mutually beneficial knowledge. Thurmond and Wambach (2004: 4) added one more dimension of interaction and that is the system. According to them, interaction in e-learning includes "the learner's engagement with the course content, other learners, the instructor, and the technological medium used in the course."

This research adopts Thurmond and Wambach's categorisation of interaction and thus, looks at interaction from the following four perspectives:

- Learner to instructor interaction

- Learner to content interaction

- Learner to system interaction

- Learner to learner interaction

Reeves and Hedberg (2003) cited four different models for evaluation of e-learning: Multiple Methods Evaluation Model, Experimental Evaluation Model, Patton's Qualitative Evaluation Model, and Fourth Generation Evaluation or Constructivist Model. Out of these the fourth generation constructivist model aligns well with the objectives of this research because it also talks about development of internal skills of knowledge construction. This research aims to investigate the link between interactivity in e-learning and the effectiveness of e-learning. As

mentioned before in this section, the scope of learning in e-learning is far higher than in traditional classroom learning in that it can not only can provide the learners' with skills but also tools and resources to become independent and lifelong learners. In other words, it can give the learners to construct knowledge independently. Going with this notion, this research considers effectiveness of e-learning from constructivist lens. This view is supported by Koohang, Riley and Smith (2009) who recommended that learning centred model must focus on constructivism as the most appropriate approach to develop an interactive e-learning system.

Several other researchers also agree that constructivism learning theory is useful and fits well with e-learning (Sultan, Woods and Koo, 2011; Koohang et al. 2009; Schunk, 2008; Woo and Reeves, 2007; Cano, 2005; Harman and Koohang, 2007; Payne et al. 2005). Broderick (2001:) state that "Instructional Design is the art and science of creating an instructional environment and materials that will bring the learner from the state of not being able to accomplish certain tasks to the state of being able to accomplish those tasks." Some researchers such as Koohang (2004) argue that adequate instructional designs which apply suitable learning theories and principles is critical to the success of e-leaning. Instructional design relies on instructional models, namely behaviorism, cognitivism, humanism, and constructivism. In last decade or so the focus has been mostly on constructivism because it promotes active learning through knowledge construction (Sultan et al. 2011; Schunk, 2008; Woo et al. 2007). In this respect constructivist theory is considered suitable for e-learning because the researcher believes that the purpose of e-learning should be broader than merely teaching subjects- it should allow learners to become independent and lifelong learners. Thus the purpose of e-learning is not only about learning the subject only but is also about learning to learn independently.

This research is conducted in Saudi Arabia. Use of internet is fast growing in both personal and professional usage. It is now acknowledged that e-learning will be the preferred channel of learning in the future (Croxton, 2014). Realising this, the Saudi government has undertaken initiatives to push for this channel in Saudi education system as well. Till a few years ago, Governments' censorship, due to fear of religiously and politically sensitive content, has been one of the main reasons for slow adoption of internet in several Middle East nations. However,

this is changing as government in countries like Saudi Arabia look to modernise their education system in order to provide a boost to the society and economy (Mirza and Al-Abdulkareem, 2011). In 2006, the Saudi government published the National Plan for ICT, the fourth goal of which is to optimise the use of ICT in education and training at all educational levels (Ministry of Communications and Information Technology (MOCIT, 2009). Saudi universities have followed this government initiative and have rapidly developed their e-learning infrastructure.

However, the continuous efforts of the government have provided limited benefits as can be seen in very low enrolment of e-learning and hybrid courses. This is worrying because e-learning will play a central role in Saudi government's achievement of its educational goals. Researcher herself is from Saudi Arabia and aims to make a significant contribution to her beloved country. Also data collection form the kingdom will be easier considering her vast network of contacts in the Kingdom. Saudi Arabian education system is in state of transition and so is Saudi society in terms of use of internet. Combining these two seems to e the most logical way forward as use of internet can help Saudi Arabian government achieve many of its development goals easily. But for this to happen, technology (that is, internet) must be deployed adequately. This makes this research very relevant in modern context.

1.5 Research questions

Based on the discussion above the key research question for this research is: how can be the effectiveness of e-learning improved by improving interactivity. This is comprised of several sub questions. It is essential to know what we mean by effectiveness of e-learning. This research will first identify the purpose of e-learning and will look to define effectiveness of e-learning. Then the second research question is what kinds of interactions exist in e-learning environment. Identifying these different kinds of interactions will help define interactivity holistically. Holistic definition of interactivity is critical for identifying how interactivity can improve effectiveness of e-learning. The third research question is what sort of link exists between interactivity and effectiveness of e-learning. The final research question is how can improving interactivity impact the effectiveness of e-learning.

1.6   Aims and objectives

Aim: To analyse the impact of interactivity on effectiveness of e-learning in Saudi higher education institutions.

Objectives:

(1) To evaluate the key differences between classroom model and e-learning model from the constructivist perspective.
(2) To study the associations between interactivity and learning in e-learning systems used in Saudi higher education institutions.
(3) To evaluate the current level of interactivity in e-learning systems used in Saudi higher education institutions.
(4) To identify ways of improving interactivity in e-learning in Saudi higher education institutions.

1.7 Contributions of the research

1.7.1   Theoretical contributions

This research provides an interesting insight into effectiveness of e-learning. It provides a detailed explanation of how effectiveness of e-learning programs should be evaluated and why the current subject outcomes based approaches used are quite narrow. This research identifies that constructivism is an effective approach in assessing the effectiveness of e-learning. Thus, e-learners must not only evaluate the gain from the course in terms of their exam but also in terms of how significantly they have improved in terms of independent learning. For teachers it means that teachers must not evaluate their own performance on basis of how much the students now

about the subject also on the basis of how independently do the students are able to carry on the learning process.

This research contributes significantly to the current stream of research on e-learning. Not only it highlights the significance of interactivity but also helps in identifying the different forms of interactivity which could play a part in improving the effectiveness of e-learning. This research also highlights that a thorough and proper induction of students into the course could be quite beneficial as it would help them overcome barriers towards use of system/technology. This is particularly critical in countries where use of technology in secondary level education is not common. For policy makers it could mean that they should promote the use of technology based learning at lower levels of education.

1.7.2   Methodological Contributions

This research marks a significant shift from the traditional positivist paradigm which has dominated the research on technology adoption. Adopting pragmatist paradigm and mixed methods strategy, this research signifies the need to move beyond simple identification of factors affecting effectiveness of e-learning. This research highlights that mixed method approaches should be adopted in order to understand the conceptualized frameworks better and to ensure that the research generates useful practical value.

Students are at the centre of decision making in whether to choose e-learning channel over classroom channel or not. In this respect, the voice and decision of the students is the most dominant one in this context and hence it is essential to listen to this voice and understand their mind. Adopting interpretivist paradigm this research highlights the need to understand the perception of the individuals in their social context and environment. The notion of giving voice to the usually unrepresented is academically important. Positivist research helps in generalization but provides very limited insight into the views of those who are at the core of the issue. As this

research has found, some of the things may not be as it seems to be in positivist research and hence obtaining greater insight using interpretivist research can help the researcher critically evaluate his / her own work.

This research also identified that a combination of focus groups and questionnaire surveys is quite useful in research on e-services. However, unlike other research, which has used these two instruments for data collection, this research adopts questionnaire survey prior to focus groups and not vice versa. In this respect, this research acknowledges focus groups as usefulness qualitative tools for obtaining insight into e-service customers' views. This research thus also supports the use of multiple data collection methods to provide cross validation of findings.

1.8   Structure of the thesis

This thesis comprises of 7 chapters. Chapter 1 presented an overview of the research including background of the study. It provided a brief review of the existing work on e-learning and interactivity in e-learning. It sheds some light on different perspectives that researchers have taken on improving effectiveness of e-learning and interactivity in e-learning. This chapter mentions some key benefits and challenges in adoption of e-banking are discussed. This chapter also discusses the reasons why studying interactivity in improving effectiveness of e-learning is essential. This chapter also presents the aim and objectives hat this research aims to achieve.

Chapter 2 of this thesis sets the context of e-learning in Saudi Arabia. It provides statistical references to the progress in adoption of e-learning education in Saudi Arabia. It provides references to the Islamic principles and how it affects the culture and education system in Saudi Arabia. It also discusses the adoption of information and communication technology in Saudi Arabia. This is followed by discussion on developments in education system and higher education system in particular is provided. The use of ICT has expanded, culminating in the

publication of the National Plan for ICT in 2006, which cited the fourth goal of optimizing the use of ICT in education and training at all educational levels. This chapter provides a discussion on the Saudi Arabia's national information and communications technology plan. National Centre for E-learning and Distance Learning was formed in Saudi Arabia to promote e-learning in Saudi Arabia. This chapter also discusses the impact of formation of the National Centre for E-learning and Distance Learning on adoption of e-learning by higher education systems in Saudi Arabia.

Chapter three provides a review of the existing literature on e-learning and interactivity. This chapter begins with a discussion of the some key aspects of e-learning including some of the current e-learning technology being used. This includes discussion of evolution of e-learning including highlighting how the use of modern technology has facilitated the transition from hybrid to completely online courses. This is followed by a discussion of different e-learning models such as blended learning, authentic learning, active learning and in depth learning. All these models form the basis of constructivist learning model which is discussed in context of e-learning. Detailed discussion is provided on the existing literature on interactivity in e-learning. One of the main drawbacks of past research is that it limits the scope of e-learning to merely acquiring information being taught and not so much on independent learning skills development. This research will focus on how interactivity helps in developing constructivist learning. Effectiveness of e-learning is discussed from different perspectives as per the researchers. Finally the theory of constructivism is discussed in detail and its relationship with e-learning and interaction is explored. A theoretical framework is proposed at the end of the chapter.

Chapter four presents the methodology used for this research. This research follows pragmatic philosophy. The reasons for selection of pragmatic philosophy and mixed methods approach is discussed in detail. The data collection and analysis part of the chapter is divided in two parts. The first part is the quantitative methodology pat which provides reasons for selection of quantitative methods. The questionnaire development process followed for this research is discussed along with discussion of the administration of questionnaires. The second part contains

details of the qualitative methodology. It begins with a explanation of why collection of qualitative data was essential to achieve the overall aim of this research. The sampling strategy adopted for qualitative and quantitative parts are discussed in respective subsections. In this research, quantitative data was used to establish the relationship between interactivity and effectiveness of e-learning while the qualitative data was used to explore the relationship in-depth.

The next chapter contains the analysis of qualitative and quantitative data. This presents the results of the quantitative data analysis including the findings of the regression analysis used for establishing the relationship between different kinds of interactivity and effectiveness of e-learning. The next section qualitatively analyses the data from the focus groups. The key themes for the focus group are identified and analysed.

Chapter six presents the discussion of the findings. Data findings from the focus group are used to explain/contrast the findings from the questionnaire survey. Comparison is drawn with existing research and explanations are provided for similarities and difference in findings.

Finally, chapter seven concludes the research. The key findings and contributions of the research are discussed along with its limitations.

1.9   Chapter summary

This chapter presented an overview of the research topic including a brief review of the key literature. It mainly talked about two aspects that are key to this research: effectiveness of e-learning and different types of interactivity in e-learning. It provided the motivation for the research based on the snapshot of the literature provided. The theoretical and methodological contributions of the research are presented followed by the aim and objectives of the research.

2. Overview of e-learning in Saudi Arabia

Saudi Arabia has invested significant amount of money and efforts in pushing for e-learning to improve the overall level of education in the Kingdom of Saudi Arabia. Despite government's initiatives, e-learning is still at early stages of adoption in Saudi Arabia while some of the difficulties and challenges of implementing e-learning are still being addressed.

2.1 Location, population and area

Kingdom of Saudi Arabia was formed in 1926 and was formally united, as it stands today, in 1932. The kingdom has been traditionally home to several tribes and this nomadic culture is can still be witnessed in certain part of the country. It remains a sacred site for millions of Muslims around the world (Alothaimeen, 2005). It is surrounded by several small states most of which are predominantly Islamic states (Abualieah, 2003). Country is quite rich in fossil fuels and has the largest known reserves of crude oil in the world.

Figure 1: Saudi Arabian map

In 2013, the population of this vast expanse was about 29.9 million, of which Saudis comprised 67.5% (20.27 million) of the total, whilst the non-Saudi population was 32.5% of the total (9.27 million) (Ministry of Planning (MOP), 2013).

15.1% of the Saudi population comprise of youth (aged 15-24), who are either currently studying in higher education institutions or will be entering sometime in near future (United Nations, 2015). Considering the rise in demand for higher level education in near future there is indeed potential of meeting future higher education challenges through e-learning. This will not only

reduce burden on the resources but will also allow education ministry to provide education to many individuals who do not pursue higher education because of certain barriers. For example, many girls do not attend university due to cultural issues.

It is thus, not surprising that Saudi government is pushing for adoption of e-learning in several higher education institutions. However, several barriers remain and one of the key barriers is poor demand for these courses as students often perceive such courses as inferior in terms of quality. Part of this perception could be attributed to poor interactivity in e-learning which affects the learning of the students (Croxton, 2014). It is thus, considered essential to investigate the perception of interactivity in e-learning form the learners' perspective and enhance it in order to increase participation in e-learning.

2.2 Culture and social life

Saudi Arabia is culturally unique because it is home to one of the most widely followed religions in the world- Islam. It is home to the two most holiest sites in the Islamic faith – Meccah and Medina. Every year, millions of pilgrims from around the world travel to Meccah for a pilgrimage, which is considered the holiest duty of every devout Muslim. Saudi national culture has derived mainly from the teachings of Islam. It encapsulates all aspects of life including but not limiting to legal system, family relations etc. Arabic is the mother tongue for most of the Saudis and although English is commonly used as a language of teaching in schools and higher education institutions, most students lack the skills to carry out higher education in English language. This has also proved to be a barrier in Saudis adoption of e-learning. English remains a minority and optional language for use in most private and public sectors (Ministry of Foreign Affairs, 2009). This is relevant to this research in several ways. Not only it affects the formation of research questions but it also affects the methodology in that the researcher need to be aware of language barriers that some respondents may face and must thus, use a combination of English and Arabic language. Also the researcher has to be careful during the focus groups as

respondents may use a mix of Arabic and English and hence adequate interpretation of data would be required involving preserving the context of both Arabic and English.

2. 3 Economy and geography

Economy and geography has played a significant part in the social lives of Saudis. The nomadic Bedouin tribes which comprise most of the Saudi population lived most of their life focused on developing harmony with the local environment. This trend has continues to play a vital role in lives of Saudis. Economy of Saudi Arabia has traditionally focused on fossil fuels. In addition to fossil fuels Saudi economy also derives a useful proportion of its revenues from metal mining but oil remains a significant contributor to Saudi economy. However, under late King Fahd there was a deliberate attempt to diversify the economy by reducing dependency on oil and promoting other industries such as manufacturing, IT, retail etc. (Ministry of Information, 2009) The education policy of Saudi government plays a vital role in this diversification as Saudi government is investing billions of dollars every year to sponsor Saudi students to go and seek higher education in reputed educational institutions around the world. The purpose is to equip Saudi young generation with skills in different areas so as to make them more employable for local and international businesses and at the same time reduce the burden on the state's resources. By doing this, Saudi government aims to diversify the skillbase of locals in order to promote development of more diversified businesses. Traditionally Saudis have relied mainly on public sector firms and state owned enterprises such as Aramco for jobs. However, government is looking to change this by adopting a more proactive education policy.

The current volatility in oil prices along with gloomy predictions for oil prices in near future indicates that his proactive policy towards diversification is indeed futuristic. E-learning can play a vital role in this policy because it would allow government to cut its expenditure- Saudi universities can provide a number of courses in collaboration with foreign universities allowing

Saudi government to cut its sponsorship costs. This will help several students who find it difficult to get places in universities of their choice due to limitations of the seats.

2.4 Information and communications technology

ICT is not new to Saudi Arabia. In fact Saudi government has been a pioneer of technological adoption in the region. In last decade or so Saudi government as undertaken several technology related initiatives in order to improve efficiency, modernise the economy and provide a boost to its economy. According to rough estimates ICT industry in Saudi Arabia is valued at around 125 billion Saudi Riyals (around £21 billion). It is thus, ranked second to oil in terms of industry size by capital. In the past Saudi government, Governments' censorship, due to fear of religiously and politically sensitive content, has been one of the main reasons for slow adoption of internet in several Middle East nations. In Saudi Arabia, internet was prohibited until 1992 when Saudi government opened it for education and medical sectors. General Saudi public was allowed access to internet in 1999 only (Ministry of Information and Communications Technology, 2008) and since then the adoption of internet has grown manifold in the Kingdom. The increased usage of internet in private and public sector as well as the general public reflects the changing perspective of the government which now views technology as a partner rather than a threat (Mirza and Al-Abdulkareem, 2011).

As the chart below indicates the penetration of internet has grown from 5% of population in 2001 to over 60 percent of population in 2014. It is expected that in the next decade Saudi Arabia will be fastest growing internet market in the whole of the Middle East.
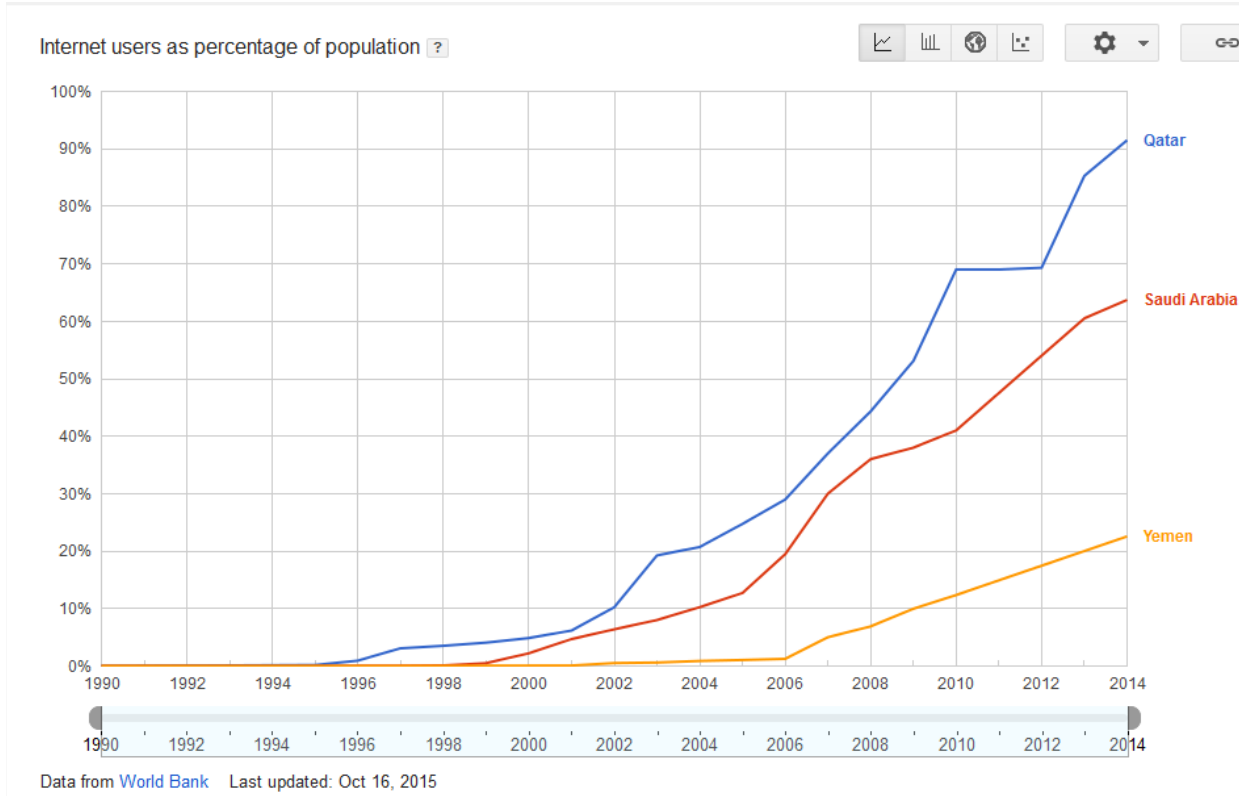
Figure 2: Internet penetration in Saudi Arabia. Source: Internetworldstats.com (2015)

The National Plan for Information and Communications Technology (discussed alter in this chapter) has played a vital role in increasing the adoption of internet in the Kingdom. It has led to a development of local ICT industry. This plan is pushed further by initiatives such as e-governance, e-banking, e-health and e-learning. In addition, the rise in mobile phone ownership has led to development of a strong e-commerce and m-commerce market. The ministry of ICT is aiming to make Saudi Arabia a knowledge economy and push for development of service industry which can cater to the demand for the local markets in the region (Ministry of Information and Communications Technology, 2008; 2009; Ministry of Education, 2010). Thus, Saudi government is supporting the IT initiative by not only providing financial support but also policy support. It is looking to foster the development of ICT sector in a strategic manner and implementation of e-learning is useful in this regard as it equips the learners with skills to use other internet based services such as e-banking, e-health and e-governance.

2.5 Education in Saudi Arabia

At the time of its inception, Saudi Arabia as traditionally focused on madressah based education and there were few public schools. Although Directorate of Public Education was established in 1925 as the first attempt to organise education (Ministry of Education, 2008; Alsenbul, 1996; Alsaloum, 1991), the real development of education policy in Saudi Arabia began in 1929 when the Shura Council ratified the original system for schooling, and the parameters of educational policy were determined gradually until another education policy document was issued in 1970, comprising 9 sections and 236 items.

Despite this development the education policies of the Kingdom remained heavily influence by the Shariah principles and were mainly focused on social aspects of life rather than on scientific aspects. The decrees allowed equal access to education for individuals (MOE, 2008) but gender based segregation in education remained as such (Alhageel, 1996; Alsenbul 1996, Alsaloum, 1991). The result of this segregation as that most girls chose subjects in social sciences while most of the scientific subjects were dominated by male learners.

The educational system of includes 12 years of schooling comprising of primary, intermediate and secondary levels. The three main streams taught in schools included religious studies (Islamic studies), science and administrative studies. It can be seen that the secondary school system focused mainly on developing skills for employment in public sector and as a result Saudi nationals dominated employment in public sector but remained a minority in private sector jobs. Government's policy in last decade has been to alter this composition and increase participation of locals in private sector as well.

The education policies are overseen by four bodies: the Ministry of Education, Technical and Vocational Training Corporation, Ministry of Higher Education and the military colleges for the armed forces (MOE, 2008). Recent education policies in the Kingdom have emphasised on increasing the adoption of science and technology education. Consequently, the government introduced ICT as a compulsory subject for all the students with every student required to attend at least one lesson per week on computer. Ministries have undertaken some other steps to push for e-learning in education institutions- for example, all the libraries have been converted into e-learning resource centres which maintain database of all published and non published resources (Algahtani, 2007). In addition, all these databases have been made available through internet. Despite this there has been a low adoption of e-learning among Saudi students because of less emphasis placed by the teachers on utilising these resources (Alzamil, 2006).

In 2008, the King Abdullah Public Education Development Project was announced. Saudi government invested nearly £1.5 billion in this project which was aimed to provide equal learning opportunities to all the individuals in the Kingdom. It was also aimed to ensure that all Saudis are equipped to the skills which they need to compete in the modern knowledge based economy (Ministry of Education, 2008). Sine all the current higher education students have been part of the current e-learning initiatives, all the students have knowledge of e-learning whether they are enrolled in an e-learning course or not. This means that a randomised sample including Saudi higher education students will be an adequate sample to use for this research.

2.6 Higher education in Saudi Arabia

This research is mainly focused on use of e-learning in Saudi higher education institutions and hence this section presents an overview of the higher education system in Saudi Arabia. The higher education policies were separated from the secondary education policies for the first time in 1975 with the establishment of The Ministry of Higher Education. It was aimed at developing policies specific towards private and public higher education institutions. Among the key

objectives of the education policies of The Ministry of Higher Education was that all capable students should receive adequate higher education, in Saudi Arabia or abroad. The focus on 1990s started to shift towards promoting scientific studies with an aim to develop a modern workforce. Realising that language can be a barrier for many students, the ministry also initiated a project involving translation of the available scientific literature in Arabic language allowing maximum proportion of Saudi students to be able to access the content of these papers despite language barriers.

Founded in 1957, King Saud University in Riyadh, was the first university in Saudi Arabia. This was followed by establishment of other universities leading to a rise in the number of universities in the Kingdom to eight in 1998, eighteen in 2006 and 23 in 2009. In 2009, Saudi Arabia had 23 public and eight private universities and around 250 colleges. Ministry of Higher Education oversees all the private and public universities in the Kingdom (Ministry of Higher Education, 2009). In 2009, there were an estimated thirty thousand teachers teaching over 700, 000 students. While all the universities have their websites but the level of technology adoption for e-learning varies in different universities.

Ministry of Higher Education also oversees sponsorship of Saudi students for foreign education. In last few years, there has been a significant rise in the number of Saudi students studying at foreign educational institutions and majority of these students are supported by government's guaranteed sponsorship scheme. What will be economically beneficial for the government is to provide advanced courses through Saudi universities in collaboration with foreign universities. E-learning could play a vital role in this regard as students can benefit from the expertise of foreign teachers without the need to attend foreign institutions. One of the issues that has proved a barrier in increasing learner-learner collaboration is the religious barrier to cross gender interaction. Consequently government has undertaken some initiatives to facilitate women education in the kingdom.

Women education in the Kingdom began in 1959 with the establishment of an all girls school. The first college for women was established in 1969. Saudi culture does not prohibit women from seeking education but requires that girls are taught separately from boys meaning that most of the universities in Saudi Arabia are either all boys or all girls (Alhageel, 1996). The usage of internet has grown far faster in males than in females because of cultural reservations of parents preventing their daughters to use internet (Alaugab, 2007).

Government sponsors free education for all Saudis and with a rise in the number of individual seeking higher education there is an increased stress on the government's funds. This is further accentuated by the growing number of Saudis seeking to study at foreign institutions on government scholarships. Government not only provides tuition fee for these students but also support them for living expenses.

Considering these aspects it is clear that e-learning could be very beneficial for Saudi Arabian government and students in the following ways (Yamani, 2014; Al-Asmari and Khan, 2014):

- It will help broadening the education service to a higher number of students without putting excessive stress on the resources.
- It will help Saudi government provide foreign university courses at lower cost within the Kingdom.
- Students will benefit from opportunities to develop their skills and knowledge without sacrificing their other commitments such as existing job.
- This will lead to an overall improvement in the skills of the Saudi students who will be able to acquire lifelong learning skills.
- Government would be able to reduce gender gaps in education allowing equal access to all the students irrespective of their age, gender, location or financial situation.
- Developing IT learning skills will help in development of a workforce which will be employable in a knowledge based economy.

2.7   National Centre for E-learning and Distance Learning

The vision and mission of the National Centre for E-learning and Distance Learning indicates Saudi government's plan to use ICT in the field of education through e-learning. This is in line with the Islamic principles of fairness as e-learning channel provides all the learners equal opportunity to learn.

The key goals of the National Centre for E-learning and Distance Learning are as follows:

- Contribute to the wider adoption of e-learning.
- Provide necessary support to researchers researching e-learning.
- Motivate researchers to carry out innovative research in the field of e-learning.
- Provide researchers and practitioners to interact with each other in order to develop the overall knowledgebase for improving quality of e-learning.
- Improve the quality of education in higher education institutions by deploying e-learning applications.
- Use e-learning to increase the student capacity of higher education institutions.
- Develop an information technology aware society by increasing awareness of technology by the use of e-learning.
- Establish standards of quality for e-learning materials.
- Develop educational software applications and promote adoption of these applications in public and private sectors.
- Cooperate with international institutions in all aspects of e-learning and distance learning.

These initiatives were applied by Saudi universities. The National e-learning centre has also initiated projects, in collaboration with universities, to push for achievement of the aforementioned objective (National Centre for E-learning and Distance Learning, 2009)

Saudi government is investing money and resources to ensure that technology use gap between western societies and Saudi society does not grow too much and is in fact adopting aggressive policies to close this gap. The proactive approach adopted by Saudi government indicates that Saudi government has put this as its strategic priorities. This drive to increase e-learning in Saudi Arabia also rhymes with the preferences of the young Saudi generation which seeks to adopt technology in all aspects of their lives. Thus, e-learning provides a win-win situation for the government and the public alike. Development of a knowledge based society is not only a desire but the basic need of Saudi society as it has relied on revenues from oil for far too long. It is unlikely that the society will be able to meet its future challenges solely based on revenues from oil especially with the growing population and demand for services. Thus, enabling the public is the best strategy for the government which it is trying to achieve through several means, a significant one of these being the adoption of e-learning.

While in the past the decision to adopt e-learning by universities was voluntary but government policies since 2006, the introduction of National Information and Communications Technology Plan, has made it essential for universities to include e-learning in their curriculum (Algarni, 2007, Alhajri, 2005). As a result there is a consistency n adoption of e-learning among Saudi higher education institutions.

Different Saudi universities use different e-learning systems. For example, the King Saud University uses e-learning software called Jusur and the Imam University uses e-learning software called Tadaurs. These systems are mainly used to publish, present, manage and store the educational content electronically. However, there is a lack of interactivity in these systems because these systems have not utilised the latest technology such as web 3.0.

It can be said that software offers most functionalities needed by universities to provide courses and manage them via the internet, including management of the admissions, registration, construction and educational content, and provides the virtual class tools, together with the capacity to build and run the exams, set and collect homework, operate discussion forums, e-mail and learner performance follow-up. In short, these systems operate the full management process of e-learning in all aspects.

E-learning is particularly useful in Saudi Arabia because it covers the regulatory gaps which prevent certain sections of the society to achieve their learning goals in full. For example, female students often find themselves restricted to non-technical courses. Also the rising demand for education is putting too much stress on country's resources. Saudi government will require opening up several new universities to accommodate the rise in number of students seeking higher education. This is not only costly but will require many years for construction. Then there is the issue of finding enough qualified teachers to teach in these universities. E-learning would allow the existing universities to expand their capacity and would thus, resolve most of these problems.

3. Literature review

3.0   Chapter introduction

This chapter provides a review of the existing literature on e-learning and interactivity. This chapter begins with a discussion of the some key aspects of e-learning including some of the current e-learning technology being used. This includes discussion of evolution of e-learning including highlighting how the use of modern technology has facilitated the transition from hybrid to completely online courses. This is followed by a discussion of different e-learning models such as blended learning, authentic learning, active learning and in-depth learning. All these models form the basis of constructivist learning model which is discussed in context of e-learning. Detailed discussion is provided on the existing literature on interactivity in e-learning. One of the main drawbacks of past research is that it limits the scope of e-learning to merely acquiring information being taught and not so much on independent learning skills development. This research will focus on how interactivity helps in developing constructivist learning. Effectiveness of e-learning is discussed from different perspectives as per the researchers. Finally the theory of constructivism is discussed in detail and its relationship with e-learning and interaction is explored. A theoretical framework is proposed at the end of the chapter.

3.1   E-learning

3.1.1 Definition of e-learning

Distance education is almost centuries old (Spector, Merrill, Merrienboer, and Driscoll, 2008) but e-learning, that is, use of electronic channels such as internet and multimedia for learning and teaching is barely three decades old (Moore, Dickson-Deane and Galyen, 2011). Depending on

the context, Electronic Learning or e-Learning has been defined in many ways (Moore et al. 2011; Nycz and Cohen, 2007). Stockley (2003:1) define e-Learning as "the delivery of a learning, training or education program by electronic means. E-Learning involves the use of a computer or electronic device (e.g. a mobile phone) in some way to provide training, educational or learning material."

E-learning has come to be known by several different names such as online learning, virtual learning, web-based learning, technology mediated learning etc. (Conrad, 2006). Generally, the use of electronic tools to facilitate a learning process is referred to as e-Learning. However, the use of some electronics microphones or data projector is not considered as E-Learning, which has led to much disagreement about the accuracy of the definition.

Nichols (2003) comment that e-learning is the learning which is accessible through internet. However, Ellis (2004) disagrees and argues that e-learning is not only internet based as it also includes content being delivered through CDs and other physical media (Benson et al., 2002; Clark, 2002) as well as digital media such as TV. These definitions were focused mainly on technology aspect of e-learning but researchers such as Triacca, Bolchini, Botturi, and Inversini (2004) and Tavangarian, Leypold, Nölting, Röser, and Voigt (2004) argue that technology alone is not sufficient to describe e-learning. According to Tavangarian (2004: 2) another possible way to define e-Learning could be "all forms of procedural electronic supported learning and teaching" that aims to "affect the construction of knowledge with reference to the learner's individual experience, practice and knowledge." E-Learning helps to improve a learner's process by enabling them to get the most knowledge from their studies through technology, applications and networking. Consequently, Kuo et al. (2014) and Croxton (2014) comment that some degree of interaction must be included in order to describe the learning experience.

3.1.2 Evolution of e-learning

In 1998, the UNESCO World Educational Report pointed out that "New possibilities are emerging which already show a powerful impact on meeting basic learning needs, and it is clear that the educational potential of these new possibilities has barely been tapped" (UNESCO, 1998, p. 19). It is evident that information and communication technology has reshaped social life in many different ways and shows potential to transform the nature of education – the role of teachers and where and how it takes place (Croxton, 2014).

As amazing as the web was before, it was a mean to post information in a specific format simply to be viewed by people (Gooding, 2008) and this availability of important information at one's fingertips astonished student and educational professionals then. Things are very different since then, however it will be a while until the institutions will have a chance to catch up with all the advancements with the web 3.0. This will allow for a more user-centred with dynamically elaborated content and a possibility of a more meaningful and greater amount of involvement, and teamwork. The problem is that the technology is moving at a much faster pace as compared to its adoption in e-learning. This creates a gap between popular technological culture and the one used for e-learning. For example, social networking and mobile apps are extremely popular today but only a few e-learning providers have started using it for providing e-learning (Croxton, 2014).

With the more recent developments and advancements in networking, students have begun collaborating and discussing with other students, teachers, experts and other resources. However, despite the evidence that there is potential in technology, studies have found that while teachers use some of the technology for e-learning but the full scale adoption of latest technology is not yet common (Kuo et al. 2014). E Learning is often content-centred (Van Merriënboer et al.

2004); the types of E-Learning that emphasize active learning and encourage social construction of knowledge and skill acquisition is uncommon. As a matter of fact, there is potential for technology to revolutionize learning and teaching both but it is still far from being successfully used in higher education.

With the pace at which communication technology are developing on the other hand, people are interested to use the virtual environments and there are also rising expectations among students. To recognize and provide for these expectations is a big challenge for institutions and professionals alike. Shin and Chan (2004) deduced that distance learners that are more connected with their educational program staff/institutions and are more aware of these opportunities and are also more likely to be optimistic about the outcomes. They are also more satisfied and tend to be willingly involved in distance learning when compared to those with a weak institutional presence. In online learning, availability and connectivity are integral to developing a strong sense of engagement and interest. Understanding the student's interests and expectations, according to Zhang et al. (2005), is the first step in integrating a distance-learning program online, which caters to their need and is a powerful learning environment.

Institutions of higher education have increasingly started to use the Internet to deliver their course material to student on-campus as well as at a distance (Ally, 2004; Kim and Bonk, 2006). The Internet provides a variety of platforms and possibilities for communication and education though different learning technology available (Weller, 2002). Sometimes, the curriculum is available to the students online and any other supplemental material is mailed to the student. For those with unreliable or slow Internet access, the whole class website can be converted into a CD-ROM. Additionally, lecturers can use the website to substitute for face-to-face instruction. Some professors use pre-programmed online activities that provide feedback on completion by student and can be use to teach students specific skills (e.g., Scott and Judd, 2002). Based on the needs of the classroom there are several ways in which the Internet and technology can be used.

With the increase in number of students there has also been an increase in number of online institutions offering online programs. Seeing this, these institutions deduced that they could make more profits when compared to traditional school because of the increase in enrolment. Studies show that if you consider the economies of scale in both cases, e-learning is higher than traditional schools (Laaser, 2008). When served in small quantities, decreasing the cost of online education becomes a crucial thing. The first thing considered when trying to cut costs is reducing the role of the instructor. However, this is one of the crucial interactions in learning. The dilemma that administration faces, therefore, is how to cut costs while being able to maintain the quality of education. As a possible solution to this dilemma, Anderson (2003) proposed the interaction equivalency theorem. The theorem states that in a deep distance course one interaction with a highly qualified lecturer is enough and all others can be eliminated or reduced. So basically, they can reduce instructor's interactions and increase one of the other interactions. Applying this theorem regardless of the features of the E-Learning program to distance learning can be a problem. Isolation is the main problem. According to Croft et al. (2010), social interaction is essential and must be asserted and this can only be done through student teacher and student-student interactions but to reduce costs the student teacher interactions need to my decreased or even eliminated.

To establish an effective interactive system that will cater to all different types of learners keeping in mind their expectations from the system for learning, and also considering that it is not enough to just give students just the access to the different learning tools (Bates and Leary, 2001). What they require is a student-centered approach that will provide the student with the necessary autonomy and control to make choices when it comes to the methods and the pace the student wished to adopt (Gibbs, 1992). They additionally required information about factors such as learners' different learning preferences, needs, interests, prior knowledge, experiences, background, culture, gender, talents and abilities.

Instructional design should be about more than just conveying information to the learner; it should also be efficient as well (Mayer, 2001), keeping in mind how the Learner-Content,

Learner-instructor, and Learner-Learner interact with one another and design it to engage the learner's accordingly. As Wagner (2008: 9) comments, "interactions that promote and enable a strong sense of social presence help keep learners engaged and motivated."

One of the educational dimensions of E-Learning is to be able to accommodate individual differences (Reeves, 1997) arising from contextual factors such as national culture (Chiu, 2009; Behl et al, 2007; Brewster et al, 2006; Istrate, 2007). The definition of a learning environment is a "space where resources, time, and reasons are available to a group of people to nurture, support, and value their learning of a limited set of information and ideas" (Rieber, 2001:3). It should be carefully treated due to its limitations both in "what can be learned" and "whose learning will be supported most" which is difficult to identify due to the complexity of human learning "which learning resources are appropriate for which people." Some researchers comment that the impact of national culture is an important influencer (Chiu, 2009) while some say that institutional readiness; trained staff and access to technology are important aspects. Additionally, it is important to pay attention to how the various needs of the learners can be met by technology (Sabry and Al-Shawi, 2008), and encourages students to participate in class activities (Leese, 2009), as well as use mobile technology for learning (Cavus and Ibrahim, 2009; Wang et al, 2009).

3.1.3 Drivers of e-learning

Over years several researchers have looked at the factors driving adoption of e-learning. One of the factors most commonly cited as driving the adoption of e-learning is the cost benefits. E-Learning is clearly more cost effective since it reduces cost of delivery and reduces the need for lecturing staff. However, there is also a high cost in the development of E-Learning (Gunasekaran et al. 2002). Eventually, the cost of savings on the staff will exceed the initial investment that they made since the materials can be reused. But, there is also the fact that E-Learning resources require continuous support which means there is an increase in number of

students. This can too be justified however by arguing that the increase in number of students will in turn lead to an increase in income. However, cost cutting through E-Learning is evidently not very straightforward.

According to some commercial organizations, replacing face-to-face training by E-Learning, they have saved a significant amount of money (approximately, 700% on investment) (Littlejohn and Pegler 2007). These returns are apparent and easy to understand. The cost of educating staff has always been a serious subject to commercial organizations (Birchall and Woolfall 2003). If pertinent, they include all costs like employment costs, training costs, which include travel and accommodation as well. It can be very expensive to train employees in an alternative site. The training costs can become too expensive if the company plans on employing a large number of employees. In cases like that, E-Learning in house can be a very appealing option and the economic scales can become more apparent (Birchall and Woolfall 2003).

According to Littlejohn and Pegler (2007), E-Learning provides a viable alternative for part time learners that cannot attend regular face-to-face sessions. Colarelli (1998) defined innovation as emergence of new technology or utilisation of technology leading to the development of new market infrastructure. In this respect, according to Patel and Patel (2006), online learning is an essential innovation. It is thus expected, that this new infrastructure for learning will lead to emergence of new suppliers and buyers. In other words, emergence of e-learning will lead to emergence of new e-learning service providers and emergence of learner communities who otherwise would not be accessing learning through traditional classroom medium. But generally speaking, most of the buyers and suppliers of e-learning has been those who would have engaged in providing and seeking learning through alternative mediums; that is, it has necessarily not led to emergence of new communities of buyers and suppliers of education. But there remains a possibility of such communities to emerge. In other words, policy makers and other interested stakeholders can promote establishment of service providers who engage in purely e-learning activities and also promote those individuals who have stayed away from the learning due to certain barriers, to seek learning through e-learning channel

In March of 2003, in the E-Universities Worldwide limited (UKeU) economies of scale were present (Bacsich 2005). A group of British Universities planned to develop and deliver "online and worldwide the best degrees and degree-level learning that UK universities can provide." (Bacsich 2005:7). A lot of good work was done with the contribution of £55 million that was donated by the UK government (Conole et al. 2005). However, it was closed since not enough students were attracted and it did not generate enough profits (Bacsich 2005; Conole et al. 2005). Some argue that access to ICT isn't motivation enough for adult learners to engage in learning (Selwyn and Gorard 2003). There are several opinions on the topic.

There is certainly a big difference between educational institutions developing E-Learning curriculum available to students worldwide and a business or enterprise commissioning an e-learning training program for their employees (Hallinger and Snidvongs 2005). One is about the demand (the enterprise) while the other is about supply (education). The cost still remains a major driver in either case. In the case of higher education institutions however, the income relative to the cost determines success or failure; the cost may be a driver but it is the income that determines whether E-Learning is a good option for higher education institutions. However, while cost remains a driver for the providers, it may not be the main driving force in the consumer (that is, learners) adoption of e-learning.

Quality improvement is the second driver for E-Learning. Research has come up with mixed interpretations about this particular driver. In 2003 a Joint Information Systems Committee commissioned a report, which concluded that even though 'improving the quality of teaching and learning' is the main driver of higher education institutions, improvements are evident in the overall student experience and not only in teaching and learning (Social Informatics Research Unit and Education for Change Ltd 2003). There is more evidence that points out that on courses that utilized ICT there was no improvement (Russell 2001). Wherever there is evidence it is found to be context dependent (Littlejohn and Pegler 2007; Pepicello and Pepicello 2003). The

quality measurement of teaching and learning has been criticized by many people, simply due to its individual and contextual nature (Ramage 2001; Shevlin, Banyard et al. 2000). Communication management and transparency are critical when it comes to improving administration activities in the context of teaching and learning (Hallinger and Snidvongs 2005). According to Conole (2004) the primary use of technology in teaching and learning is still its administration, therefore making this an important finding.

The third driver of E-Learning is the widening participation. Widening participation means providing access to education to learners who would not traditionally consider a higher education (Macdonald and Stratta 2001). According to Littlejohn and Pegler (2007), E-Learning provides a viable alternative for part time learners that cannot attend regular face-to-face sessions. An example can be students that have to work or have other family commitment and therefore cannot attend daily classes (Procter 2003), or others that cannot engage in learning for other reasons (Asgarkhani 2004). And an example of the latter would be students with disabilities who could benefit from the assistive technology to aid learning (Santos 2006). Adapting E-Learning certainly exposes one to a Virtual Learning Environment, however these are not accessible to everyone yet, like visually impaired students (Jenkins et al. 2001).

3.2   Different perspectives on e-learning

3.2.1   Blended learning

Self-directed learning that precedes student-centred learning has been defined as a process "in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes" (Knowles, 1975: 18). The leaner in this way is the centre of the process. Gibbs and

Habeshaw (1989: 37) comment that "students learn well when they take responsibility for their learning including freedom to waste the opportunity as well as freedom to exploit it in the best possible way."

A student centred course allows the students to navigate their education while making a clear commitment to the course. "It therefore involves considerable delegation of power by the lecturer and an equivalent assumption of responsibility by the students" (Martin, 2000). In that case, the student centred learning implies "need for students to assume a high level of responsibility in the learning situation and be actively choosing their goals and managing their learning. They can no longer rely on the lecturer to tell them what, how, where and when to think. They must start to do this on their own, independent of any instruction" (Sparrow, Sparrow and Swan, 2000). Di Napoli (2004: 3) comments that student centred learning "recognised that students learn in different ways and have different learning styles" and that learning is "an active dynamic process." Furthermore with student centred learning, "the individual is 100% responsible for his own behaviour, participation and learning" (Brandes and Ginnis, 1986: 12).

Several universities have added online material to their pre-existing traditional methods or have added computer components to their approach. However, according to many comparative studies, the learning outcomes do not differ (Russell, 2001; Twigg, 2003). Merino and Abel (2003), for instance studied engineering student to compare the effectiveness of computer based tutorials to traditional teaching methods. They found no significant difference in the outcomes from the two teaching methods. Another study, with students studying biology online and traditionally led to the same conclusion (Johnson 2002). Holman (2000) tried to evaluate the difference when library material was used and yet again came to the same conclusion.

From these finding one can safely conclude that replacing traditional methods with computer-based learning do not mean that there will be improvement in student outcomes. To improve the

student outcomes the computer based programs should be more student-centred in their methods of instructions. A few have suggested that the entire course will need to be restructured to make "the teaching-learning enterprise significantly more active and learner-centered" (Twigg, 2003, 30). Yoon and Lin (2007) said that it is extremely important to have the how and why at the forefront when designing a blended course. So blended learning can therefore be defined as "an optimal combination of face-to-face and online education that improves learning and the satisfaction of instructors and students" (Bourne, Harris and Mayadas, 2005). The two main reasons that educators are keen on using the blended approach is the increased access to resources and flexibility and also improved pedagogy (Graham, Allen and Ure 2005).

Blended learning methods are a student-centred approach that allows students control over the pace of learning while developing active learning strategies and enhancing peer assisted learning which is why it is consistent with improved pedagogy (Graham, 2005). According to Bourne et al. (2005) blended learning is about utilising online tools to create self-paced units to build basics for students to participate in interactive exercises.

Since it should be focused on the students it is essential to provide the students with high level of accessibility and flexibility in the learning environment. The students that take up online education, which allows them easy access to the course material, also want social, face-to-face interaction (Utts et al, 2003). The blended approach allows for this by providing the materials as convenient as well as the social aspect. Subic and Maconachie (2004: 35) posit that blended learning environment "aims to enable students to take much more responsibility for their own learning by focussing on what the student does." Blended practice promotes the adoption of deep approaches of learning facilitated by group activities by using active learning and reflective practices.

3.2.2   Authentic learning

According to several researchers, active engagement is extremely important for learning outcomes (Brown and King, 2000). Constructivists believe that learning happens through social interactions among people when they engage in dialogue and share their experiences.

The word "interaction" has replaced the word "engagement" in educational literature (Rhode, 2008). Interaction according to studies plays a vital role in online education, since the students are geographically away from the professors as well as other students and can develop a feeling of isolation. This results in a decrease in motivation and then that leads to an undesirable outcome for the institutions offering these online courses (Croft et al. 2010). Several studies have tried to address different aspects of e-learning in order to address and overcome shortcomings bring efficient learning, for example, student-centered design (Uskov, 2004), reusability of learning resources (Uskov, 2004; Wills et al., 2002; Aroyo and Dicheva, 2004), design in a way that enhance learners' motivation (Astleitner and Hufnagl, 2003), problem-based learning (Slough et al., 2004).

Herrington and Herrington (2006) opposed that situated learning should be an approach in e-learning design that helps to implementation of authentic learning. They believe that the elements of authentic learning are "authentic context, authentic activities, collaboration, reflection, access to expert performance, multiple roles and perspective, articulation and authentic assessment." This provides a real world learning experience and environment that have loosely-defined tasks for students. They provide videos and case based learning so that students can see what type of tasks and activities professionals do. In the traditional setting, a teacher's role has changed from presenter to facilitator of knowledge. The teacher emphasis is replaces by collaboration and teamwork and even the assessment is not conducted conventionally through essays and exams but rather through diagnosis, reflection and self-assessment. This changes the student's role from a mere passive learner to a knowledge seeker. They learn to discover and create knowledge rather than simply receive it.

Hung and Chen's (2001) design framework identifies four design considerations (Situatedness, commonality, interdependency and infrastructure) for e-learning systems. Situatedness in e-learning system is provided by internet-based systems that allow access to students whenever they want it so they can reflect as they go along the material. Commonality is when students are able to interact with other like-minded students with the same interests in a scaffolding structure and this requires that the tools for communication be provided to the students. Novices need expert help and opinion, which helps the novices and independency in e-learning environments, is developed over time. For instance, they can be called experts in their field in the community or collect scores for sharing the information. The advancement in technology has provided many resources to facilitate communication between students and teachers. The learner's various needs are now met by advancing asynchronous and synchronous computer mediated communication, for instance, a synchronous learning tools can be used for learning and discussion while synchronous communication can provide social support for the learners (Hrastinski, 2008). Additionally, combining both forms of communication can be highly satisfying as well and institutions that are using these technology are trying to improve them. However, these institutions face problems when it comes to the funds that are allotted towards developing e-learning and distance learning, they view these are extremely limited and cannot overcome this hurdle. Anderson (2003) proposed the interaction equivalency theorem, which focuses on the problems that universities face. According to him, to establish a deep formal learning a high level of interaction is sufficient rather than developing of high level of all interactions or middle level of them.

3.2.3   Active and Passive learning

Active learning happens in an environment where students are allowed to talk, listen, read, write and reflect on their knowledge while dealing with the course content. Some of the ways that this can be done is through problem-solving exercises, small groups, simulations, case studies, role-playing, among other activates that are application based and relevant to the content (Meyers and Jones, 1993). Active learning is an attitude towards learning that is developed through

encouraging the student to actively participate in the process of learning. However, other think those by watching videos, and browsing the web the students are in fact becoming more passive since this does not require much engaging (e.g., Roberts, 2001).

Students actually need to be engaged in higher-order tasks so they can go beyond simply listening – tasks like analysis, evaluation and synthesis. CS educators have introduced active learning methods into their classes by means of in-class activities or group-work or even sharing individual solution with class to encourage participation. A classical example is to ask the student to write their answer or work the problem on the board that way the students answer benefits the entire class and all students also benefit from other students mistakes and unique or different approaches (Simon et al., 2004). This kind of interaction can help the professor judge the students understanding as well and make a call as to how they want to deal with the material.

Passive learning, in contrast takes place in a transitional classroom setting where instructors present the information and the students merely take notes. Students are expected to have a clean slate or an empty vessel or a sponge like approach to the material and soak in the information as it is without necessarily applying it in any way. According to some educators, this is based on common sense (McManus, 2001).

Students that are used to larger classes and prefer passive learning are often hesitant when it comes to active learning due to their familiarity with the traditional lectures McKinney (2007). It is therefore important to explain the benefits and the importance of the active learning method to these students in order to prepare them to use these methods. Teachers may also require some prior training before they can administer these methods (Niemi, 2002). Active learning can be implemented inside as well as outside a classroom through tools like computer simulations, internships, online assignments, Internet discussion lists, or independent study (McKinney, 2007). Active learning can be used at all levels of education from first year undergrads all the way through graduate students. Large sized classes should not mean that there is no active

learning, in fact it is all the more important to promote active learning in these settings (McKinney, 2007).

3.2.4 Deep and surface learning

There are two key approaches that describe the way we learn and interact with our environment – deep and surface learning. Marton and Saljo (1976) carried out the original work on approaches to learning. In one particular experiment, two groups were given some material to learn that they will then be tested on. The two groups took two different approaches to learning this – one focused on memorizing the facts that they thought were important while the others tried to understand the whole meaning of the text. The first group are the surface learners while the second group are the deep learners. A third method called "achieve" learning was identified by Atherton (2005, para.2), which was defined as "a very well-organised form of surface approach, and in which the motivation is to get good marks."

Deep learners focus on what they think is important and they relate this to their previously acquired knowledge. Deep learners also tend to implement this acquired knowledge to their daily lives. Through their own efforts they structure and organise the material into a bigger picture. Surface learners on the other hand, don't relate problems they encounter to a main concept but only focus on how they will be assessed (Ramsden, Beswick and Bowden, 1989). Deep approach to learning has been researched in great detail (e.g., Atherton, 2005; Notess and Neal, 2006; Smith and Colby, 2007) and is now encouraged as the optimal way of instruction in the classroom although it is very difficult to achieve this. Notess and Neal (2006) suggested five approaches that an instructor needs to apply in order to usher a student towards deep learning:

-   Make sure that the course is well organized, paced, and communicated or this could disappoint, discourage or even frustrate the students.

- Develop authentic activities that feel more real than imitation, and relate them to the to the real world so that the students can relate as well.

- Give the students more control of the course content by allowing them to select the required reading or the type and topics of their assignments.

- Select activities that require application, analysis, synthesis and evaluation, thus challenging the students and raising the standard of discussion.

Sometimes teachers may not have received appropriate or enough training and this can be a problem when considering deep learning outcomes (Smith and Colby, 2007:205). Teachers must promote intentional rather than accidental efforts to enable deep student learning.

3.3   Learning preferences

Learners differ in several aspects, such as in their abilities, learning styles, intelligence, personalities, perception and behaviour (Riding and Rayner, 1998). They differ on many psychological levels and these individual differences influence the type of mental operations (Parkin, 2000). Knowing about what learners prefer in terms of assistance in gaining knowledge, helps in strategising as to what will work best for the learner. Since all human beings are different and perceive the would differently, and understand and learn about things in their own way in conditions that they prefer and therefore it becomes very important to investigate and understand the differences (Pask, 1988; Birkey and Rodman, 1995). Many authors have studied the notion of perception as a different between people (Biggs, 1999; Prosser and Trigwell, 1999). Perception is the conscious awareness of your surroundings sensations (Goldstein, 2005). Perception is not just a response to a stimulus; it is the result of a complicated cognitive process (Harre, 2002). It gives the person a view of the world, which helps them interact safely and effectively with the environment by stressing the important and disregarding the irrelevant (Sekuler and Blake, 2002). How students approach a given task and the success they achieve is determined by their perception towards the work.

Often, learners use different learning strategies (Riding and Rayner, 1998), interpret and process information differently (Felder, 1993), and as a result, develop different patterns of behaviour that makes them comfortable called their learning style (LS). "Learning style" refers to the way in which a student likes to learn – seeing and hearing, reflecting and acting, reasoning logically and intuitively and analysing and visualizing (Felder and Soloman, 1988).

The interest in learning styles began in the mid-1980s. Changing the way they teach to cater to the needs of the student and their learning styles was suggested by Felder and Soloman (1988). Instead of a radical change in instruction, they suggested that people adopt certain techniques to appeal to the different learning styles in students. A learning style model was proposed by Kolb (1984, p 21), which used terms such as experiential learning theory (ELT) and learning styles inventory (LSI). This model operated of two levels – the first acknowledges four different types of learning styles: concrete experience, reflective observation, abstract conceptualization, and active experimentation (represented in the figure below) and the second level focuses on four types of learning: diverging, assimilating, converging, and accommodating (Kolb, Boyatzis and Mainemelis, 2001). According to Kolb's model there are four types of learning abilities - Experiencing, Reflecting, Conceptualising, and Planning, and learners choose what to use depending on their situation.
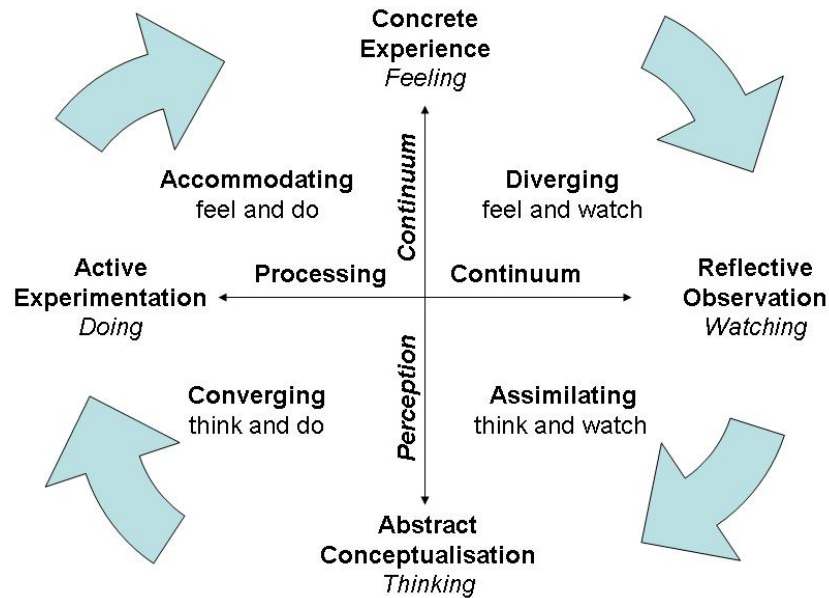
Figure 3: Kolb's Learning Styles and Experiential Learning Model. Source: Clark (1995)

Rosati, Dean and Rodman (1988) studied the relationship between students' learning styles and instructors' teaching styles. In an experiment with a group of engineering students, they were divided into two heterogeneous groups and to study the interaction based on their learning styles and how they were instructed. The first was for the students who prefer to rely on their experience as oppose to theory and tend to proceed in a step-by-step manner from the starting point. The second was designed for students who understand abstract symbolic theoretical relationships and rely on intuition and inspiration. They used the Myer-Briggs type indicator of personality as an indicator of the students' learning-style preferences. The study showed that students' performance could be enhanced if the teachers recognize and acknowledge individual learning styles.

Keefe (1979: 4) states that LS are considered to be "characteristic cognitive, affective, and psychological behaviours that serve as relatively stable indicators of how learners perceive,

interact with, and respond to the learning environment." Felder and Soloman (1988) categorised four main learning styles. Active and reflective learners tend to understand information by actively engaging with it. Sensing and intuitive learners like to learn facts and they obtain possible relationships between the facts. Visual and verbal learners mostly get more information from seeing or from written or spoken words. Finally, sequential and global learners depend on the sequence of the information presented to them. Human beings are complex and this makes it a challenge to find one style that may be able to represent every individual (Lockitt, 1997).

Every single human is a complex, distinct and sophisticated individual and is a result of several characteristics like experiences, cultures, environments, attitudes and other variables, which is why an evaluation can never be complete, and is merely a step to understanding a student's needs.

Howard et al (1996) attempted to integrate the various learning theories - Felder's (1988) learning styles, Kolb's (1984) learning cycle and Bloom's (1956) taxonomy, which they described as "a hierarchical representation of the students depth of knowledge in a given subject or cognitive domain" (p.227). They developed a blueprint of several teaching tools, which were divided equally and used it with a science class throughout that semester. The conclusion was that there are several possible techniques and tools to improve student performance in a classroom setting.

Dunn and Dunn's (1990) developed a model called the Visual, Auditory and Kinaesthetic (VAK) learning model and this is widely used in schools in the United States. The model consists the principles, learning style elements, identifying each student's learning style, and its impact on the instructional situation. The main assumption in this model is that "Most individuals can learn" (Dunn, 1990, p.1).

Instructional approaches, resources and environments depend on the strengths of the various learning styles. Everyone has different strengths. There are individual preferences with respect to instruction style and this can be successfully measured. Statistically, get students higher achievement and attitude test scores in matched, rather than mismatched treatments provided they have suitable environment, resources and approaches. Teachers can learn the concept of learning style as the foundation of their instruction and students can learn to use their learning style strengths to learn difficult academic material more efficiently and effectively (Dunn, 1990).

The University of Newcastle-upon-Tyne conducted two studies to evaluate the models of learning styles and their impact on post-16 education (Coffield et al., 2004). Their main questions were - which models are influential or can potentially be influential? And what is there is empirical evidence to support the claims made for these models? On reviewing Dunn and Dunn's model, they concluded, "despite a large and evolving research programme, forceful claims made for impact are questionable because of limitations in many of the supporting studies and the lack of independent research on the model" (Coffield et al., 2004: 35).

3.4 Interactivity

With the increase in number of students there has also been an increase in number of online institutions offering online programs. Seeing this, these institutions deduced that they could make more profits when compared to traditional school because of the increase in enrolment. Studies show that unless you consider the economies of scale in both cases, distance learning is higher than traditional schools (Laaser, 2008). When served in small quantities, decreasing the cost of online education becomes a crucial thing. The first thing considered when trying to cut costs is reducing the role of the instructor. However, this is one of the crucial interactions in learning. The dilemma that administration faces, therefore, is how to cut costs while being able to maintain the quality of education. As a possible solution to this dilemma, Anderson (2003) proposed the interaction equivalency theorem. The theorem states that in a deep distance course

one interaction with a highly qualifies lecturer is enough and all others can be eliminated or reduced. So basically, they can reduce instructor's interactions and increase one of the other interactions.

Applying this theorem regardless of the features of the E-Learning program to distance learning can be a problem. Isolation is the main problem. According to Croft (2010), social corrected is essential and must be asserted and this can only be done through student teacher and student-student interactions but to reduce costs the student teacher interactions need to my decreased or even eliminated.

According to Allen (1999) interacting learning is a process that combines traditional resources, such as textbooks, with hands-on activities for students to work together in groups or interaction with tutoring software or another appropriate media tool. Interactive learning is an important learning style that involves learning by doing and experimenting with knowledge in order to understand it.

To provide interactive learning and achieve deep learning the instructors need to use and adopt the latest technology and communication media that the students are already using (Rajasingham, 2010). Even before the process of higher education begins, students can collaborate with professors and among themselves.

According to Mayes and Fowler (1999) there are three stages of learning and they can be supported by three kinds of courseware involving conceptualization, construction and dialogue. At the conceptualization phase, learner views resources online like lecture slides or notes, then in the construction phase, they apply the knowledge to tasks that can be performed on the computer based assignments and tests and lastly the dialogue stage is where the actual active learning

happens through feedback from instructors about their performances and this can be supported by using online discussion or other social interactions.

Learning cycle   Type of Courseware
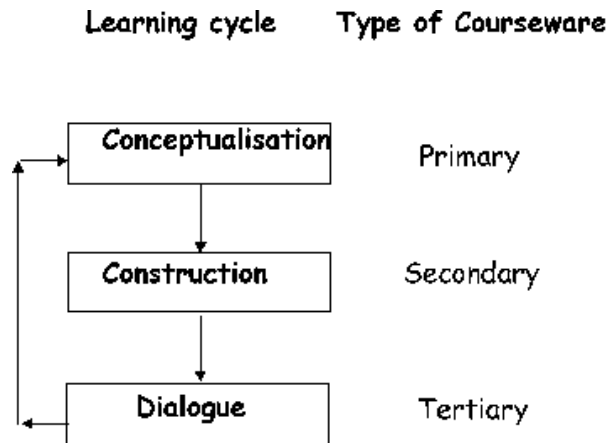
Figure 4:   **Mayes Learning Cycle**

Salmon (2002, p.3) introduced the concept of "e-tivities" or online learning activities as a framework to improve active online learning by individuals or groups. E-tivities are important because of their ability to produce useful pedagogies for learning by focusing on their implementation through network technology. Even though Salmon suggests that e-tivities can make a significant difference in learning, little gratifying and cost effective online teaching has been produced.

The terms interactivity and interaction are often used when speaking of e-learning or online education, but what exactly they mean in the context is unknown (Street and Goodman, 1998). Interactivity can be thought of as a "fundamental mechanism for knowledge acquisition and the development of both cognitive and physical skills" (Barker, 1994, p1). It provides relevant interactions, various choices of interaction patterns (Evans and Sabry, 2003). Interactivity is difficult to define especially because of its connection to learning. Learning can be defined in many ways, for example, "a way of interacting with the world" (Biggs, 1999), "the adaptation of the learner's ability to respond appropriately to a given task" (Obitko et al, 2001), and/or as "an

active process of constructing knowledge" (Duffy and Cunningham, 1996). The process of education can be viewed as the communication of knowledge to the student (Siemer and Angelides , 1998), according to Wenger (1987), can be defined as "the ability to cause and/or support the acquisition of one's knowledge by someone else, via a restricted set of communications". Furthermore, the extent and type of learning interaction varies according to learning theory. For example, behaviourism involves repetition of routine activities, and prompt feedback (El-Saddik, 2001), cognitivism involves exploring, experimenting and solving problems (Anderson, 1996), and constructivism involves construction of knowledge through real life situations (Koshmann, 1996). However, Snelbecker (1999) warn against using these learning theories as absolute rules and recommends using these merely as guidelines.

Learning goes beyond mere interaction with the information or knowledge, it involves interaction with others as well (Boud et al, 1993), it therefore involves a complete commitment (Alexander and Boud, 2001). The various interactions can shape interactivity of learning in different ways: student-content interaction refers to how interactively the student can access the information presented, student-teacher interaction refers to how interactively the teacher delivers the content and the skills required for the student to access the content independently, and finally the student-student interaction refers to the extent to which the students to interact with their peers in order to exchange information and knowledge through social communication (Moore, 1989; Hillman et al, 1994; Moore and Kearsley, 1996).

Anderson (2003) proposed the interaction equivalency theorem. The theorem states that in a deep distance course one interaction with a highly qualifies lecturer is enough and all others can be eliminated or reduced. So basically, they can reduce instructor's interactions and increase one of the other interactions. Applying this theorem regardless of the features of the E-Learning program to distance learning can be a problem. Isolation is the main problem. According to Croft (2010), social connection is essential and must be asserted and this can only be done through student teacher and student-student interactions but to reduce costs the student teacher interactions need to my decreased or even eliminated. To know student's perceptions towards

interaction equivalency there must be one or two of the interactions at a high level. For instance, courses that are designed such that they require student interactions and participations with one another to complete their assignments or projects will enhance interdependency and improve collaborative working skills simultaneously. This improves student-student interaction greatly since collaborations and discussion of the assignment brings them together by establishing the need for interdependency.

This interdependency is discussed in the context of the Social Interdependency theory (SIT). Johnson and Johnson (1989) refers to Social interdependence as "when outcome of individuals' tasks are affected by her/his tasks and others' tasks." In that case, there are two kinds of social interdependence: positive interdependence and negative interdependence. Positive interdependence exists when individuals' work impacts joint outcome of theirs and others. Negative interdependence exists outcome of individual's work depends on the failure of his/her competitor (Johnson and Johnson, 2009). Dependencies can be applied to organizations, environments, schools and online communities then division of assignment tasks named task interdependence is identified (Victor and Blackburn 1983), employees people are expected to study, work together as a result.

Most learning is independent and people learn best at their own pace, in their own time and in places they chose to, often around other people or learners (Race, 1994). Harashim (1989) emphasized the benefit of active engagement on leaning, sharing information and perspectives when interaction with other learners. Once again, the terms interactivity and learning consist of overlapping aspects such as interaction with other students and teachers. They also involve active engagement over passive engagement and the extent and type of interaction vary according to the learning theory. According to Sabry (2005), interactivity can be defined as, "the engagement of learners in the learning process through the interaction between the four main components of learning systems (figure 1) including: Learner, Information, Pedagogy and Technology, with a carefully balanced design of the 3-e-learning interactions taking into consideration the learning preferences of the target population (Learner component)."

Investigating role of interactivity in effectiveness of e-learning

Learner

Individual factors (learning style, age, prior experience of using subject and internet usage, language skills). Access to technology

Interaction design

Design decisions considering learner's factors, subject, pedagogy as well as availability and usage of technology.

Subject

Information related to the subject.

Subject taught

Aim and objectives of the course

Skills to be developed

Technology

Information related to different technology

Different technological tools used to achieve goals

Usability, interactivity, navigation

Pedagogy

Information related to learning/ teaching methods

Information about learning theories such as instructivism, cognivitism and constructivism.

Methods and styles of teaching and learning

Figure 5: Components of an Interactive Learning System. Source: Sabry (2005)

3.5   Different types of interaction in e-learning

Interaction is widely discussed in e-learning literature because of its relationship with pedagogy. Most of the researchers agree that interaction is key to achievement of the goals of e-learning (Kuo, Walker, Schroder, and Belland, 2014; Croxton, 2014; Ozkan and Koseler, 2009), especially the pedagogical outcomes (learning (Dennen et al., 2007; Beuchot and Bullen, 2005; Garrison and Cleveland-Innes, 2005; Russo and Campbell, 2004). These researchers argue that structuredness cannot replace interactivity. Several empirical research has concluded that interaction is key to learners' satisfaction and perception of the quality of the quality of education (Garrison and Anderson, 2003; Rochester and Pradel, 2008). In literature, the terms, 'engagement' and 'interaction' are used interchangeably (Rhode, 2008). Interaction allows active engagement of the learner which is essential for not only his knowledge of the subject but also for the development of independent learning skills (Croxton, 2014). Constructivism has emerged as the front runner among the theories used for explaining the effectiveness of e-learning. Constructivist learning requires social interaction among all the participants of the learning environment including the teachers, students and other support staff.

Researchers have adopted different approaches to categorise interaction in e-learning. For example, Schone (2007) categorised it according to the levels as passive, limited, complex and real time. Passive interaction refers to the interaction which occurs in different time frames; for example, when one individual posts the message and other individuals reads the message at some time in future and where there is a significant time gap between posting and reading of message. This is very common in forums and blogs. In one sense in this kind of communication, communication at any given point of time is one way. Complex interaction involves use of factual data and simulation to give the learner experience of real life. This is aimed at generating higher level of interest and knowledge among the learners. Real time interaction occurs when there is two way communication occurring between two individuals in real time. This often happens through use of video conferencing.

Davries (2001) proposed the term vicarious interaction where individuals learn by observing others. It may not be a direct form of interaction but is interaction nonetheless because it involves two individuals. Interaction in e-learning environment is far different from that in traditional classroom environment because in e-learning environment the individual is dependent on the technology for facilitation of interaction. This means that individual may not be in complete control of the level of interaction. In terms of type of interaction there is not much difference except that the types of interaction may have a different dimension. For example, student-system interaction in classroom environment will involve access to library, and other physical resources which have their limitations. On the other hand, in e-learning environment it will involve the technology itself as well as the ability to access the online resources.

Different institutions use information technology for different purposes. Harmon and Jones (1999) found five different levels of use of information technology in e-learning: (a) informational, (b) supplemental, (c) essential, (d) communal and (e) immersive. For obtaining complete benefits of e-learning it should be immersive. Similarly, Ryan (2001), spoke of the different ways of implementation of e-learning such as self-paced independent study units, asynchronous interactive or synchronous interactive settings. This is very similar to the Schone's (2007) categorisation of the type of interaction in e-learning.

Moore (1989) first categorised interaction in e-learning from the perspective of the learners. He categorised interaction as student-student, student-instructor, student-content, and student-interface. Moore's categorisation of interaction is used in this research with slight modification that student-interface interaction is altered to student-system interaction. This is to reflect that as a learner, student do not only interact with the interface but with the system as whole which includes not only the interface they use but also the system which contains all the information that the users are trying the access.

Following subsections discuss the different types of interaction as per this research.

3.5.1   Student-content interaction

Origin of e-learning could be found in distance education which has been practiced for more than a century. In distance education, learners received the content and relied solely on the content provided to them to develop their learning. It is still being practiced in certain countries where low penetration of internet creates barrier in use of e-learning. Distance education is mainly useful in bridging the spatial distance between the learner and the teacher. In distance education focus was on creating interactive content so that the learner can learn without any interaction with the teacher. So the learner was his/her own teacher (Lee and Rha, 2009). Consequently, several teachers and academic in the universities around the world invested their efforts in developing self-study content which was interactive and simple for the learners to follow without any instructions. In distance education content was distributed to the learners either as hard copies or as multimedia disks (Peters, 1998; Lee and Rha, 2009). In these cases, student-teacher interaction was replaced by self explanatory and well-structured course material.

Moore (1993) conceptualized this as structure which is contrary to dialogical learning. Structure here refers to the designing of the course including its elements such as course material, learning

objectives, activities, assignments, evaluation (Moore and Kearsley, 2005). In case of e-learning structure also involves structuring of the interaction between the instructor and the learner. Structuring is akin to the script of a movie in which every action, reaction and every word of the actors is prewritten in such a manner that it is understood consistently across the whole of the film unit (Moore, 1993). Similarly, structuring in e-learning is carefully laying out the content in such a manner that it can replace direct instruction from an expert and so that it conveys a consistent message to all the learners despite difference in their perspectives. Hence this content has to be extremely detailed.

Several other researchers have supported focusing on the structure/content of the course material (Ostlund, 2008; Lee, 2004; Chen, 2001a, 2001b). These researchers believe that well structured content can replace teacher-student interaction to a significant extent (Lee and Rha, 2009). Kearsley and Lynch (1996) argue that high structure is essential for success of distance education program. William (2006) supports this views and comments that inclusion of instructional design components has a significant bearing on the performance of distance education students. Stein et al. (2005) goes as far as suggesting that structuring and interaction in distance education are more significant than any student characteristics such as their technical capabilities.

According to Moore (1993), without student-content interaction, distance education would yield no learning. Students can construct knowledge with the help of the content that is provided by the teachers. Earlier in distance learning, their content was limited to textbooks that were used by the students and teachers would help them overcome any difficulty they have with the material. Now, although students still spend time with their content, the advancement in technology has introduced many different types of contents to our lives like, reading informational texts, watching instructional videos, interacting with multimedia, participating in simulations, using cognitive support software, doing the assignment and working on projects (Abrami, et al. 2011). Distant educators should focus on choosing the appropriate content for the needs of the learner.

Teacher's focus on providing value added content is the main reason why a lot of emphasis is placed in student-content interaction in e-learning (Muilenburg et al. 2005). It can be argued that even teacher's find it difficult to interact with e-learning students at the same level as they can do with classroom students and hence they try to compensate this with providing a very detailed course content. There are several components of Student-content interaction such as the course material, structuring of the course such as assignments, workshops, as well as technological tools such as presentations, links to the websites where the students can obtain useful information etc. Student content interaction holds significant value in e-learning mainly because of the emphasis placed on this by students and teachers alike which leads to a certain degree of dependency on the content. In addition, there is a broader variety of content in e-learning as compared to classroom learning. Together the content of the e-learning courses can create a social constructivist environment where students can create the knowledge independent of any instruction (Benbunan- Fich, 2002).

Lee (2004b) indicates that structures and interaction are conflicting in that high structuredness reduces interaction. This can be somewhat true because excessive structure leaves little scope for the learner to explore on his/her own and self construct knowledge. Moore (1993) discussed the two from theoretical perspective. Following the Interaction Equivalency theorem he suggests that higher the degree of structuredness in a course lower is the required level of personal interaction. On the other hand, when there is low level of structuredness, learners and teachers make more effort in constructing knowledge and this requires higher level of personal interaction. Thus, providers must carefully decide about the degree of structuredness that they desire in e-learning courses. A suitable approach could be to balance the two. Providers can also consider the cost of providing structured content and that of providing personal interaction elements and decide what could be achieved under the given budget constraints. Also useful is to consider the characteristics of the learners themselves i.e. their ability to decipher the knowledge and their prior experience of the content they are studying. While teachers can help the learners but irrespective of the possibilities of e-learning, teachers cannot be available all the time for all the learners and hence some degree of reliance on content will always be there.

Student-content interaction is quite critical in context of e-learning. This is so because e-learning benefits from a vast amount of information. In fact in many cases there is abundance information but the drawback of this is that the information is so abundant that it is not possible to structure this information. In fact many times there is conflicting information available in online resources and it requires critical analytical skills to identify accurate and relevant information. If e-learning is extremely structured, student may get used to structuredness and in that case they may not be able to achieve their goal of constructivism. Considering this argument, high degree of structuredness goes against the principle of constructivism and hence focus should be more on improving interpersonal interaction. This research will look into whether student-content interaction is useful in improving constructivist learning in e-learning.

Based on this discussion one of the hypothesis for this research is:

Hypothesis: Student content interaction influences the constructivist learning of the students

Peters (1998) argue that e-learning providers must carry out experiments to identify ways to balance the benefits of e-learning with the pedagogy. He talks of the trade off in the e-learning which the researcher has also argued about in the first chapter. Peters (1998) suggests that the two extremes- completely interactive and completely structured are not optimal and something in the middle should be achieved to ensure that best of both is achieved.

Indeed, several other researchers have also argued that interactivity and structuredness are contrary to each other but some critics argue that they can be both complementary with one substituting for the other. In this respect, Moore (1993) contends that structuredness, to some degree, is about dialogue (Gorsky and Caspi, 2005). Similarly, Saba and Shearer (1994) contend that there is a systemic and dynamic relationship between structure and dialogue. They argue that the transactional distance depends on the balance between the two, that is, the two exist in tandem with one increasing when other decreases. They act as counterbalance of each other.

Moore and Kearsley (2005) contend that structuredness is key to success of e-learning courses but at the same time they also argue in support of interactivity. According to them while structuredness is useful but it cannot substitute for interactivity, at least not completely. The question, that remains is to what degree structuredness is desirable and to what degree interactivity is useful in improving effectiveness of e-learning (Stein et al., 2005). There is no clear answer to this question and a lot depends on the context (Moore, 2004). For example, in certain courses it may be essential to have structuredness while in some others interactivity may be the key ingredient. Other factors such as learner's ability to independently learn also affect the choice between the two.

3.5.2   Student-teacher Interaction

Student-teacher interaction is the single most critical aspect of classroom model (Moore, 2004). Student-teacher interaction is different from student-content interaction in that student-content interaction is more about how the course is structured while student-teacher interaction is more about how the two interact. In this respect content is independent of the teacher; for example, teacher can teach content developed by someone else. Student –teacher interaction includes the direct and verbal communication/ engagement between the two. This is interpersonal communication which occurs between the teacher and learner in and outside the context of the study (Lee, 2004b). For example, teachers often act as mentors for students helping them learn beyond the limits of the subjects. This is a kind of interaction which occurs beyond the limits of the subject because technically, as a teacher, teacher's role is not about mentorship. These are the ancillary benefits of interpersonal interaction between the teacher and the learner.

Moore and Thompson (1990) argue that teacher's feedback is critical to the learning of the student. The question is to what degree student-teacher interaction is useful in e-learning. Su et al. (2005) argue that while student-teacher interaction is useful to certain level, too much of this interaction is not desired by e-learners. For example, they argue that many students do not wish to reply to every message that they receive from the teacher.

While some researchers have argued in support for more interaction between the students and the teachers but the critics argue that more is not always better when it come to student-teacher interaction in e-learning. For example, Mazzolini and Madison (2003) observed that increased efforts of interaction by the teacher, through increased number of messages, would not result in increased interaction from the students. On the contrary as increased message postings by the teachers led to a decline in message exchange from the students- their messages got shorter and the delay in reverting back became more. Dennen (2005) also observed that teachers, in an effort to revert back to each and every query, posted around 50 percent of the messages themselves.

Consequently Dennen et al. (2007) talks a threshold level beyond which the interaction form the teachers become obstructive for the students thereby leading to a decline in participation from the students. They also argue that part of the problem is some instructors' lack of ability to communicate fluidly, effectively and efficiently in online environment. One strategy proposed to overcome this weakness is to increase the level of structurisation of the course, which could reduce the need for teacher interaction (Dennen et al., 2007).

However, too much emphasis on structurisation is not advisable. Although e-learners are somewhat independent learners but leaving them in complete isolation is not the right strategy (Moore and Thompson, 1990). It is very important to allow the students to interact and engage with their teachers so that they can learn from the teachers. Despite the highest degree of structure, no e-learning material can completely replace the role of the teacher in the overall learning of the students (Morris, Mitchell, and Bell, 1999). According to these researchers,

interpersonal interaction between the participants of the system helps in acquiring and assimilating information thereby allowing building the knowledge among the learners (Garrison, 1993). The increased use of internet in personal and professional lives have made it easy for individuals to interact. For example, one of the most common platforms for interaction in e-learning is the web discussion boards. It allows individuals to interact with each other without any impact of the physical distance between the two.

Most of the studies in the field of e-learning talk about the benefits of interaction in e-learning on the pedagogical outcomes of e-learning and consequently several researchers have focused their efforts into finding more innovative ways of interaction (Beuchot and Bullen, 2005; Dennen et al., 2007; Garrison and Cleveland-Innes, 2005; Kehrwald, 2008; Novitzki, 2005; Russo and Campbell, 2004; Tu and McIsaac, 2002; Weaver, 2008; Lee and Rha, 2009).

Zhao, et al. (2005) in their meta-analytic research concluded that of all the available forms of interaction in e-learning the most significant one is the student-teacher interaction.. This was supported by Magjuka, et al. (2005) who concluded that e-learning success depends most significantly on the interaction between the human participants that is learner to learner interaction and learner to teacher interaction.

Shih, Martinez-Molina and Muñoz (2008) provided more in depth study on the role played by teachers in e-learning and concluded that teachers can improve effectiveness of e-learning by providing constructive and prompt feedback to the students. Teachers can also support the students in learning how to use the system because different individuals can have different perceived IT self- efficacy. In this manner the teachers can lift the level of performance f the students and help reduce the rate of withdrawal, which is unfortunately, quite high in e-learning courses. In addition, by designing the course appropriately the teachers could promote learner-learner interaction, which considering the role of social interaction in human performance, is going to help the students both personally and professionally (Abulibdeh and Hassan, 2011).

Feedback based system where the teachers and learners can both continuously obtain feedback from each other are quite useful. The role of teachers in motivating students to achieve higher goals with e-learning could not be emphasised enough (Shih, Martinez-Molina and Muñoz , 2008). Verbal communication by giving praise, humor and self-disclosure and non-verbal communication for example, body language (eye contact and facial expressions) are critical factors which are important for increasing of learning outcomes are some used by teachers in traditional education (Bouhnik and Marcus, 2006). In distance education however, other forms of interactions are available to students and teachers that are different from the traditional ones. Moore, in his transactional theory posits that for a decrease in transactional distance education, communication between students and teachers must become more frequent. Communication usually happens through emails, discussion boards and video conferencing depending on what is available (different media) and the needs of the student and teacher. There is a shrinking level of transaction in the above-mentioned media, for instance, students feel more connected to their teachers and peers through video conferencing than through email. Interaction with the teacher and their presence in both traditional as well as distance learning is very important in motivating students (Hrastinski, 2008).

Arbaugh (2000b) investigated the impact of interaction on students studying in online MBA course. According to him, ease of interaction, the interaction dynamics and teacher's emphasis on promoting interaction were the three most significant aspects with the perceived satisfaction of the students in terms of learning. Indeed in distance courses where students are not familiar with each other, the onus is on the instructor to motivate them to interact with each other. Arbaugh (2000b) finings could be however, biased considering that the participants of the study were interacting with each other any way as they were also attending a on campus course. Achieving interactivity in hybrid course is not as much of a challenge as in purely e-learning courses where the participants do not see each other and have never met. In a study of hybrid learning system similar to Arbaugh (2000b), Volery (2001) also found the level of classroom interaction to be a strong predictor of the effectiveness of the course. In addition, Volery (2001)

concluded that the role of the teacher is no more than of an instructor but is more of "a learning catalyst and knowledge navigator" (p.77).

Based on this discussion the researcher presents this hypothesis:

Hypothesis: Student-teacher interaction influences the constructivist learning skills of students

On question that the researchers have been trying to answer is whether the learner-teacher interaction should be asynchronous or synchronous. Indeed the current technological tools provide for both kinds of interaction; for example, instant messaging systems and push mail systems help in synchronous communication while online boards and email provide for asynchronous interaction (Abulibdeh and Hassan, 2011). By using either of these systems the learner and the teacher can interact without the need to be physically being in any given location.

Easton (2003) carried out a qualitative research investigating the process o communication which affects the role of teachers in online courses. According to her the teachers in the online courses require similar communication skills as does the teachers in classroom based courses. Consequently, she recommends developing new strategies and approaches for making virtual teaching more effective. In particular she recommends identifying the best tools for mediated communication, for example, web discussion boards or e-mail.

Designing an effective online course is time-consuming and broad as compared with traditional courses. There is huge difference with regard to the discussion group, teamwork, lectures and all other tools used compared to the traditional educational system. The teacher's role in the course is the element of the course that poses the main challenge (Wallace, 2003). How teachers can accomplish their main goals of attending in discussion boards, assessing students' work and teaching is still something they are trying to find an effective solution to.

As an instructor the teachers sets the curriculum as well as design methods for delivery. For example, the teacher may decide to give a full presentation or just update the links that the students must visit to access contents. He can also impose time limitations as well as establish etiquettes for interaction. As an instructor the teacher remains in control of the whole learning process (Anderson et al. 2001).

As a facilitator the teacher will identify areas of disagreement and promote critical thinking among students. He would look to improve ability to reflect and seek knowledge. This would also involve acknowledging and encouraging students' contribution. According to Gibson (2002), teacher's role in e-learning system changes from 'centre stage' to 'guide on the side'. As a facilitator the teacher sets the environment for learning such as by drawing in the participants and encouraging discussion and debate. While ding this he maintains the efficacy of the whole process (Anderson et al. 2001).

The third mode is the direct instruction mode in which the teacher presents the content and asks relevant questions while posting critical issues on the discussion board. He also summarises the discussion board. The most significant aspect of such a mode is diagnosing the misconceptions. Teacher must consider different perspectives from different sources. Finally the teacher also needs to resolve the technical issues that the students may face in using the online system (Anderson et al. 2001).

3.5.3 Student-student Interaction

The third form of interaction according to Moore is student-student interaction. This refers to the interaction between students. Students in e-learning environment can communicate with each

other using synchronous technology such as instant messaging applications or through asynchronous technology, such as email. An increasing number of students are also using social networking platform to interact with individuals. Most individuals have mobile phones with several social media applications installed. This ubiquitously available source of interaction has immense potential for usage in e-learning. Increased interpersonal interaction between learners enhances their perceived social presence and thus promotes learning (Gunawardena, Lowe and Anderson, 1997). Studies show that it is the most basic form of interaction in traditional classroom. Students through this interaction learn from each other, find solutions to their problems that they face in their studies and work together to find a solution to them (Gunawardena and McIssac, 2003).

Learning is an active process and in this approach it is achieved through engaging actively rather than the traditional passive approach. Student are expected to make something new from the information and the knowledge that they are given and not merely take the new ideas and concepts that are given to them by their teachers. Effective learning in rich context: learning is effective if the learners are asked to solve a problem and education is based on students' activities. Teachers pose the students with questions and problems and the students starts their activities by solving this challenged that is put in front of them. Learning on the other hand is a social process, which in collaborative learning happens through communication. An 'intellectual synergy' of ideas is created when students propose their thoughts to one another and have to do so to get the desired outcome (Smith and MacGregor, 1992).

Based on this discussion the researcher presents this hypothesis:

Hypothesis: Student-student interaction influences the constructivist learning skills of students

Knowledge can be defined in many different ways. Drucker (1989) differentiates between information, data and knowledge and stresses that knowledge is specialized by definition. Siemens (2006) asserts that knowledge rests in an individual and resides in collective. The difference between implicit knowledge and explicit knowledge is an important one. Explicit knowledge is a logical knowledge that is collated in formal language while implicit knowledge is difficult to verbalise and to communicate. Through knowledge sharing in an educational setting, and individual's implicit knowledge becomes the community's explicit knowledge and then transform the community's explicit knowledge into an individuals' implicit knowledge. This transformation increases knowledge in community and the potential for innovation among learners as well. Institutions provide advanced knowledge sharing to learners by establishing these learning communities (Wei, 2009).

Cognitive participation means reflecting on one's own knowledge and skills and use it to enhance the overall knowledge/ skills of the group. Cognitive participation is required to overcome complex challenges in e-learning but for simple issues such as socialising and course planning simple personal interaction should be sufficient. In case of cognitive participation, it is best done using asynchronous channel as it puts less pressure on the participants and participants get enough time to reflect and participate. However for personal participation, synchronous channels are considered useful because they retain the real time communication element which is critical for satisfactory personal interaction (Abulibdeh and Hassan, 2011).

3.5.4 Student-system interaction

Kear, Williams, Seaton, and Einon (2004) suggested three different use of ICT in e-earning. Firstly, they suggest that ICT is used to support a resource-based learning approach where the students are given a wide choice of learning materials. Secondly ICT is used to allow students to participate in virtual communication. And thirdly, ICT is used to promote an active approach to

learning. In this manner ICT play a critical role in all aspects of e-learning. However, the role of ICT is considered more of an enabler of communication and information exchange rather than having a significant bearing on the process of communication. Despite this, the role played by synchronous and asynchronous communication technology in facilitating communication between participants cannot be ignored.

Hara and Kling (2001) carried out a qualitative assessment of learners' experience of e-learning courses. They found that while the instructors were competent, students often complained about poor performance of the technical aspects of the course. It led to several problems such as difficulty in obtaining feedback, ambiguity in the communication etc. and all this led to feeling of anxiety and low morale. However it can be argued that their research was carried out around 14 years ago and there have been significant improvement in technology since then. For example, instead of low speed dial ups, we now have high speed broadband connection, computers with faster processing powers combined with applications which allow seamless communication. This should have resolved several issues that were highlighted in their research. Nevertheless their research highlights the fact that poorly performing technical systems could affect learner's satisfaction levels and hence it is essential to have an acceptable level of technical performance.

Based on the review of the literature the researcher presents this hypothesis:

Hypothesis: Student-system interaction influences the constructivist learning skills of students

Researchers have also investigated the link between perceived IT self efficacy and perceived performance in e-learning courses (Marakas et al. 1998). According to past research there is a strong link between the two. This could be one of the reasons why e-learning courses are more

popular for technical subjects as the students in these courses have higher perceived IT self efficacy.

In terms of IT self efficacy the researchers identified two different forms of IT self efficacy. Firstly, the linking of the course content itself and secondly the ability to use the available technological tools to access the content and interact with other participants (that is, the teachers and other students) within the e-learning (Johnson et al. 2000). Researchers have concluded that IT self efficacy has a direct and positive relationship with the performance of individuals in e-learning setting (Bates, 2006; Gaythwaite, 2006). However, DeTure (2004) disagrees and comments that IT self-efficacy is not a good predictor of student success in e-learning course.

3.6   Constructivism

 "Constructivism has multiple roots in the psychology and philosophy, among which are cognitive and developmental perspectives of Piaget, the interaction and cultural emphases of Vygotsky and Bruner, the contextual nature of learning, the active learning of Dewey, the epistemological discussions of von Glasersfeld, postmodernist views, and the paradigm and scientific revolutions of Thomas Kuhn", says Driscoll (2000: 375). Constructivism learning theory is rooted in the theories by psychologists like Piaget (1972), Vygotsky (1978) and Bruner (1990) and can be defined as the active construction of new knowledge based on previous knowledge. Piaget's theory of knowledge (1970) was based on the assumption that learners must construct their concepts of the world through observation and active learning and not just by copying or simply absorbing it. Driscoll (2000: 378) summarizes Umberto Eco's "rhizome" metaphor about learning theory: "The rhizome models the unlimited potential for knowledge construction, because it has no fixed points and no particular organization. Eco also spoke of a jar full of marbles, which, when shaken, will produce a new configuration and a new set of connections among marbles". According to Cunningham (1992: 171) "the rhizome concept alerts

us to the constructed nature of our environmental understanding and the possibilities of different meaning, different truths, and different worlds."

Piaget strongly believed that knowledge is a self-constructive process therefore his view can be considered as constructivist. This knowledge is not yet discovered and is out there, the learner actually invents and reinvents it over and over as through their interaction with the world. Learners accordingly engage with their environment actively and acquire knowledge through it. There are several stages and processes that learners go through – "the processes assimilation, accommodation and equilibration, are critical to development and to advancing between stages." Usually, learners will perceive new information based on their pre-existing schemes and will have to accommodate these accordingly. Accommodation is when learners modify their schemes to fit the newly acquired information. Finally, the process of equilibrium process eliminates the conflict and disequilibrium between the pre-existing schemes and the newly acquired sophisticated mode of thought. The central element of Piaget's theory of learning and development is language – as learners advance through the stages and processes language acquisition plays a vital role, especially since we make sense of the world through language (Piaget, 1973).

Like Piaget, Bruner defines discovery as a process of acquiring knowledge using one's own mind and not by accident. One expects to find regularities and relationships in the world around them and with this expectation, learners device strategies to find these relationships or regularities. The nature of this process is an attitude of construction – there is a urge to reconstruct the previous knowledge as one encounters the mental constructs and contradictions when discovering new knowledge.

According to Driscoll (2000: 375) "learners must acquire the ways of representing the recurrent regularities in their environment." Vygotsky hypothesized that development is the transformation of social relations into mental functions. Individuals learn by actively modifying

their situations in a process of response, in a process known as mediation, which is nothing but linking the social learning with psychological and mental learning.

Language allows us to connect the outer world with our inner mind. The manner in which something is spoken has a significant impact on how we understand it. During the interaction the communication occurs through a social prism which allows us to decipher the meaning conveyed. For example, our minds process not only he words but also the tones because same thing said in different tones could mean different things.

Vygotsky suggests that learning is socio-cultural construction and language plays a significant role in our construction of knowledge. Language is a kind of cognitive tool that helps the individuals in deciphering the meaning of the messages conveyed. The messages themselves are not mere words but contain subtle signals towards the psychological stance of the communicator as to his emotions and feelings. By ensuring that the learner can understand the language, the communicator could ensure that the messages are delivered as intended. It is essential in case of learning because failure to have the same language of communication will lead to misinterpretation and failure of the whole learning process (Vygotsky, 1978). It is often considered that e-learning environment is a very formal learning environment and all communication that occurs should be formal. However, in higher education institutions, it is essential to develop self learning skills and this means that teachers need to support independent learning and for this it is essential for teachers to communicate with students in a less formal tone. Thus, the role of language which is toned down from highly formal to a mix of formal and informal cannot be ignored. The problem with highly formal tone is that it lead to high task orientation which may not be ideal achievement in context of e-learning. Hence teachers should use a combination of formal and informal language to communicate with the students.

Constructivists believe that knowledge is a "web of relationships" and is actively constructed by learners as they try to make sense of their environment and experiences. In this manner

knowledge construction is a dynamic process and occurs in a cyclical manner- we learn and apply and we learn new things and apply them again. Our experiences lead to new kind of behaviour which continues to bring new experiences leading us in a cyclical process of learning and behaving. Scholars such as Vygotsky and Piaget call this the schema accommodation and restructuring. This is clarified by Perkins (1991: 20) who commented that "regardless of what is being learned, constructive processes operate and learners form, elaborate, and test candidate mental structures until a satisfactory one emerges. Moreover, new, particularly conflicting experiences will cause perturbations in these structures, so that they must be constructed anew in order to make sense of the new information." Most constructivists believe that learning is a never ending process and we continue to learn till we die (Brown, 1989). In this respect applying constructivist model of learning in e-learning is useful because tools available today provide us with a range of options for learning and going by constructivist approach, we can continue to learn throughout our life.

Constructivists believe in contextual learning and argue that it is not possible to separate learning form the context (Duffy and Jonassen, 1991). Also the constructivist believe that learning occur as a result of some meaningful activity. Constructivists also believe that learning occurs autonomously and individual learn must thus, have high level of self-awareness so as to be able to clearly identify what they wish to achieve.

Honebein (1996) argue that learning is embedded in our life experiences. It occurs in a complex but relevant environment. Similarly, De Vries (2002) argues that learning occurs through social negotiation which includes our existence in cooperative and socio-moral environment. One of the key aspects of constructivist model of learning is rhat it proposes self ownership of learning (Duffy and Cunningham, 1996) that is it believes that individuals are in control of their own learning. According to Jonassen (2003) we all are naturally self aware of the process of knowledge construction. As we learn through ur ocial experiences we do not need to make any additional efforts to convert information into knowledge. We are self programmed to do that.

Dewey (1966) suggested that learning happens most effectively by doing. The action based learning is the most effective form of learning as it registers the knowledge in our mind as an objective reality. This may be the reason why more and more teachers find practice based learning more effective rather than taught.

Woolfolk (1993: 485) argues that "the key idea is that students actively construct their own knowledge: the mind of the student mediates input from the outside world to determine what the student will learn. Learning is active mental work, not passive reception of teaching."

In real world individuals do not act alone. They see things happening aroud them and could possibly learn from the experience of others. This is the reason why collaborative learning could prove useful as individuals can share their experiences and knowledge. According to Dewey (1966) "education is not simply transmission of knowledge, but, in its broadest sense, is the means of this social continuity of life." Similarly, Bruner (1986:127) contends: "learning in most settings is a communal activity, a sharing of the culture." Thus learning best occurs when there is an environment of active exchange of information which means hat in highly interactive environment. This research is based on the view the higher the degree of interactivity in online environment the better will be the learning. Collaborative learning helps individuals "develop their own plans and understandings through joint effort and have the opportunity to come to new understanding through the give-and-take of interaction, argument and discussion" (Watson et al. 1999: 142).

Solutions can arse synergistically in a constructivist field through collaboration Brown, 1989). Collaboration also exposes learner to other's point of views and therefore has a strong potential to change all the involved interactants. Cooperative learning explicitly and implicitly focuses on values, consideration, fairness, respect to others, helpfulness, personal responsibility therefore making a socio-moral classroom environment that governs the classroom (Watson and others, 1999: 142). According to Edelson (1996 in Driscoll 2000), "advances in technology starting with

the personal computer have assisted in broadening the form that collaboration takes to include not just discussion but sharing of artifacts and cooperative work across time and distance. Moreover, the potential is there for technology to play a revolutionary role in supporting new forms of learning conversations in educational settings." For instance, thanks to technology there is opportunity for social interaction and negotiation even in e-learning through a variety of means like chatting, forums and blogging, and web projects.

Constructivist leaning environment reflect the complexity and diversity of life in their approach. Not all principles that are considered general necessarily apply to everyone in a particular situation. This is because people are different in so many ways because of the different social backgrounds that lead to varied perceptions. Constructivists welcome these varied perspectives (Duffy and Cunningham, 1996; Honebein, 1996). The diversity of perception is expressed through negotiation among the learners. Spiro (in Driscoll 2000: 380) states, "revisiting the same material, at different times, in rearranged contexts, for different purposes, and from different conceptual perspectives is essential for attaining the goals of advanced knowledge acquisition." Additionally, he proposed that hypermedia provides the necessary tools for this. It be used to encourage construction of new ideas, theories, literary works or whatever, from several different perspectives (Cunningham, 1992). They can also build a systematic knowledge base that allows the exploration of the multiple interpretations. Reviewing the same content through several different modes allows for different aspects of it to be revealed. Cognitivists support the idea of multiple modes of delivery of instruction in classrooms (Driscoll, 2000).

Since the Constructivist theory is based on the idea that learners construct their own meaning to learn, it is necessary for them to take responsibility of their own learning and develop autonomy as well as content. They need to be given the freedom to chose and negotiate the content and work by themselves on it. To achieve this teachers must establish their role are a facilitator to coach and students must be encouraged from the beginning to reflect, investigate and apply the content. Honebein (in Wilson, 1996: 12) emphasized that "learners might have difficulty in navigating a learning environment or try not to so on their own accord is that such environments

have typically been decontextualized, however, tasks that are thought to be difficult when attempted in a decontextualized environment become intuitive when situated in a larger framework, that is, a more authentic context." Teachers should allow for some thinking time before and during activities so that learners can evaluate and analyse all perspectives.

Research concurs that constructivism is a great approach for e-learning because is ensures that learning happens (Mödritscher, 2006). Situated learning is greatly emphasized by constructivists as it is contextually based learning and allows the learner to contextualize the information through activities in the online interaction (Anderson and Elloumi, 2004). In most educational setting the teacher plays a role beyond observing and assessing, they help facilitate discussion and engage the student as they perform their activites, they pose questions to promote understanding and reasoning. Constructivists view the teacher as an advisor or a facilitator and the active learner as the centre of the process. Teachers will help the learner to use their embedded background and culture to discover their own version of the truth (Hung, 2001).

Learning should be an active process where learners do high-level activities. Teachers must engage students in activities like trying to apply the information to a practical situation, facilitating personal interpretation of learning content, discussing topics within a group, assessment and so on. Experiences and social interactions play a role in the learning process (Anderson and Elloumi, 2004).

According to the Constructivist pedagogy, the learner and not the tutor is the centre of the learning experience. In e-learning, it is difficult to maintain the role of the tutor all the time but it does provide the student with all they need making it more student focused. Students have the choice to study what they want, where they want, how they want and also with who they want to study with. Therefore Internet based learning accelerates the process of a shift to a student centred learning experience.

Looking through a constructivist point of view, the achievement of these conditions will be impossible to replicate merely with books. The learners need to be liberated from the confines of the books by teachers and instructional design, especially in the case of language learners from the rigid and restrictive rules of grammar and classrooms is even more important.

Constructivists see knowledge as being built through individual experiences and applied. E-learning allows for context-based and work-based learning where the learner is the centre of the learning experience and students have more responsibility toward their own learning. With the help of online technology, students can easily record and reflect upon their material. A Constructivist see a student as an active participant in their own learning process as opposed to being an empty can that waits to be filled with information. E-learning forces learners to seek out information and to be adventurous making connections and exploring it as a social experience to build knowledge. E-learning also enables communication between learners without the problemswith factors like time and place.

Mayes and de Frietas (2002) summarised the constructivist view of learning as follows:

- Knowledge is constructed by the learner through achieving understanding
- Learning relies on what we already know, or what we can already do
- Self-regulated learning
- Goal-oriented learning
- Cumulative learning

The term 'constructive alignment' was coined by Biggs (2003) to express the concept behind program specifications, declaration of intended learning outcomes and criteria for assessment and its uses (Houghton, 2004). Biggs supports active learning by encouraging learners to buils

their own knowledge rather than accepting whatever they are told passively. Biggs (2003, p.13) summarized his claim by stating that "Education is about conceptual change, not just the acquisition of information."

To achieve the desired learning outcomes, alignment requires the teachers to set up learning environments that support learning activities. Teaching methods should consequently be aligned with the learning activities that assume the intended outcomes and this should be done such that it engages the learner and ensure that the learning outcomes are achieved.

Biggs (2003) proposes four main steps to achieve constructive alignment:

- Defining the intended learning outcomes.
- Choosing teaching/learning activities that are likely to lead to achievement of the intended learning outcomes.
- Assessing students' actual learning outcomes to see if they were the same as what was intended
- Arriving at a final grade

Some argue that a well-designed course is based on a close relationship between these mentioned essential elements. A poorly designed course on the other hand will not develop these close relationships and will consequently make it difficult to achieve the learner's goals. Honebein (1996: 11) predicted a set of goals that help the design of constructivism in learning settings. The key goals are to "Provide experience with the knowledge construction process; Provide experience in and appreciation for multiple perspectives; Embed learning in realistic and relevant contexts; Encourage ownership and voice in the learning process; Embed learning in social experience; Encourage the use of multiple modes of representation; and Encourage self-awareness in the knowledge construction process."

Perspectives: Multiple perspectives and representations of concepts and content are presented

and encouraged.
Control: Goals and objectives are derived by the student or in negotiation with the teacher or system.
Role: Teachers serve in the role of guides, monitors, coaches, tutors and facilitators. The student plays a central role in mediating and controlling learning
Tools: Activities, opportunities, tools and environments are provided to encourage metacognition, self-analysis -regulation, -reflection and -awareness.
Structure: Learning situations, environments, skills, content and tasks are relevant, realistic, authentic and represent the natural complexities of the 'real world'. Primary sources of data are used in order to ensure authenticity and real-world complexity. Collaborative and cooperative learning are favoured in order to expose the learner to alternative viewpoints. Knowledge complexity is reflected in an emphasis on conceptual interrelatedness and interdisciplinary learning.
Process: Knowledge construction and not reproduction is emphasized. This construction takes place in individual contexts and through social negotiation, collaboration and experience. The learner's previous knowledge constructions, beliefs and attitudes are considered in the knowledge construction process. Problem-solving, higher-order thinking skills and deep understanding are emphasized. Errors provide the opportunity for insight into students' previous knowledge constructions. Exploration is a favoured approach in order to encourage students to seek knowledge independently and to manage the pursuit of their goals. Learners are provided with the opportunity for apprenticeship learning in which there is an increasing complexity of tasks, skills and knowledge acquisition. Assessment is authentic and interwoven with teaching

Table 1: Characteristics of constructivism learning theory. Source: Murphy (1997)

The role of the instructors is quite critical in case of constructivism especially in context of e-learning (Alzaghoul, 2009). To be effective teachers, e-learning instructors should promote independent learning and should support this by providing useful instructions to the learners. They should allow the students control their own learning process; for example, allowing them to make their own decisions while benefitting from tutor support when required. Teachers should

promote collaborative and cooperative learning by focusing on activities that are interactive and will facilitate constructivist learning (Mödritscher, 2006; Hung, 2001). Finally by using examples to illustrate theory, learning should be made more meaningful to the learners.

Implementing online resources and computerized applications, the Internet, website and the virtual learning environment in the context can benefit learners with the numerous possibilities it has to offer. Thanks to CD-ROMs and Self-study websites, learners now have a more liberal setting for the classroom unlike the rigid classroom setting and this could encourage autonomy by providing them the opportunity for ownership in learning.

3.7   Conceptual framework

Based on the literature review the following hypotheses have been identified:

Hypothesis H_1:   Student content interaction allows students to learn their subjects better.

Hypothesis H_2:   Student-teacher interaction allows students to learn their subjects better.

Hypothesis H_3:   Student-student interaction allows students to learn their subjects better.

Hypothesis H_4:   Student-system interaction allows students to learn their subjects better.

Hypothesis H_5:   Student content interaction in e-learning develops students independent learning skills.

Hypothesis H_6:   Student-teacher interaction in e-learning develops students independent learning skills.

Hypothesis H_7:   Student-student interaction in e-learning develops students independent learning skills.

Hypothesis H_8:   Student-system interaction in e-learning develops students independent learning skills.

Hypothesis H$_9$: Student content interaction motivates students to learn independently without formal instruction.

Hypothesis H$_{10}$: Student-teacher interaction motivates students to learn independently without formal instruction.

Hypothesis H$_{11}$: Student-student interaction motivates students to learn independently without formal instruction.

Hypothesis H$_{12}$: Student-system interaction motivates students to learn independently without formal instruction.

Based on the these hypothesis the following framework has been conceptualised
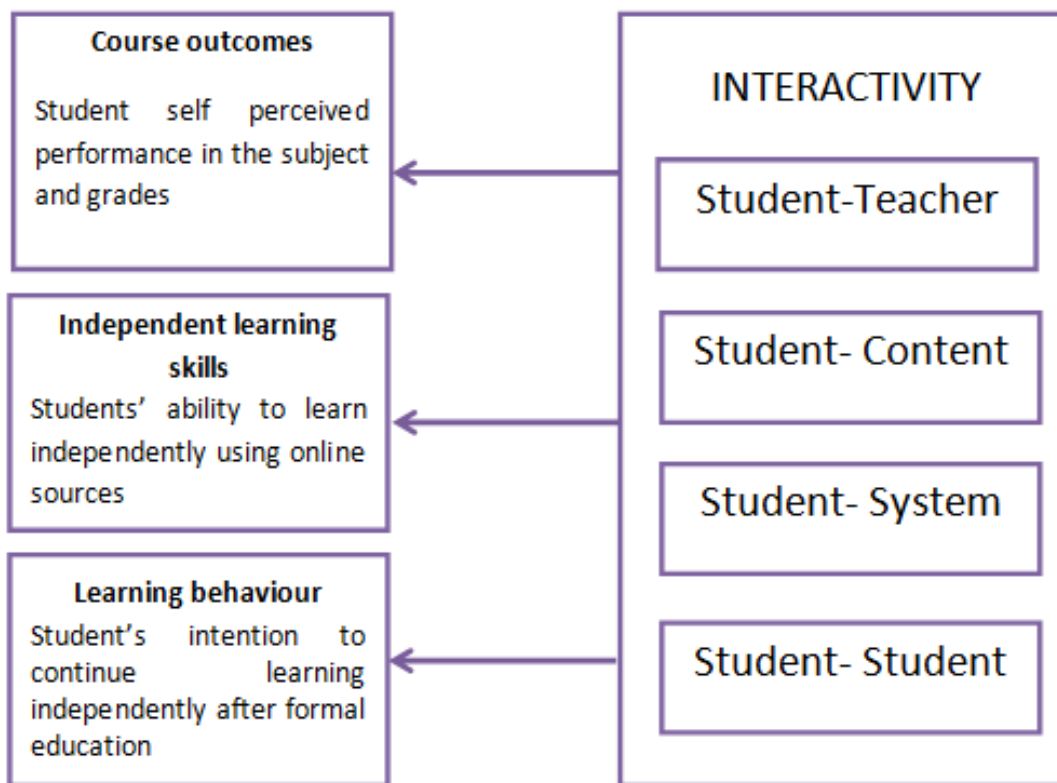
Figure 6: Initial conceptual framework

3.9   Chapter conclusion

This chapter presented an overview of the existing literature in the field of e-learning, interactivity in e-learning and the theory of constructivism. It began with defining e-learning. In past distance learning has been used but while e-learning could be categorised as form of distance learning but it is very specific in the manner in which the content is delivered. In context of this research e-learning is defined as the process of teaching and learning that occurs using internet as a medium.

Next the development of e-learning with the development of internet technology (both software and hardware) are discussed. The development of new application and internet enabled devices combined with increased adoption of internet around the world has made it possible to use e-learning at a mass scale. It is envisioned that in future a large proportion of the population, in both developed and developing countries, will be connected through internet and in this manner e-learning can be a useful tool in reaching out to the people who, due to certain barriers, cannot access formal educational mediums. These barriers could include personal and professional, responsibilities, time shortage, geographical location, costs etc. E-learning is a very cost effective medium of overcoming all these challenges.

In addition it is also discussed that e-learners can customise it according to their own needs. They can learn what they want, from whom they want, when they want and whenever they want. The high degree of customisation possible in e-learning can help the learners overcome several barriers that keep lot of people from seeking higher education.

Several drivers of e-learning are discussed. The problem with current e-learning systems is that these are developed by the providers for the providers. In other words, these systems are mainly designed for the providers to be able to provide teaching service to a large number of

geographically dispersed individuals without the need for significant investments. However, this research argues that the potential of e-learning is much more than this if the perspective of e-learning service is shifted from providers' to learners' perspective.

The different e-learning models are discussed. Blended learning model is the model in which the students are self directed learners. This relates to the theory of constructivism in which the learners are also constructors of knowledge. It is recommended under the blended learning model that teachers should focus on empowering the students, that is providing them skills by delegating power to the students. research also indicates that merely adoption of internet as channel for delivery of education will not result in better outcomes but for this to happen computer based programs should be more student-centred in their methods of instructions.

Next the model of authentic learning is discussed. Authentic learning is characterised by authentic context, authentic activities, collaboration, reflection, access to expert performance, multiple roles and perspective, articulation and authentic assessment. In this model emphasis is on collaboration and teamwork and even the assessment is not conducted conventionally through essays and exams but rather through diagnosis, reflection and self-assessment.

Active and passive learning models are discussed. E-learning as the potential of turning learners into active learners because they have access to all the tools and resources that they need for their learning. However, it is the responsibility of the teachers to turn them from passive to active learners. This should lead to deep learning rather than surface learning. Surface learning here refers to learn what has been taught and nothing more. Deep learning refers to learning in-depth where the learner explores more and learn more, beyond what has been taught to him/her by the teacher.

Next the section discussed the literature on interactivity. Definition of interactivity is provided along with a short discussion on the difference between interaction and interactivity. The focus of this research is interactivity but interaction is a mechanism through which the overall level of interactivity can be improved. Learning goes beyond mere interaction with the information or knowledge, it involves interaction with others as well and therefore involves a complete commitment. One of the most significant problems in e-learning, which affects learners' satisfaction, is the lack of social interaction. This is mentioned under the social interdependence theory which postulates that outcome of individuals' tasks are affected by her/his tasks and others' tasks.

This is followed by a discussion on the four types of interactivity that exist in an e-learning environment. There are several components of Student-content interaction such as the course material, structuring of the course such as assignments, workshops, as well as technological tools such as presentations, links to the websites where the students can obtain useful information etc. Student content interaction holds significant value in e-learning mainly because of the emphasis placed on this by students and teachers alike which leads to a certain degree of dependency on the content. Interactive content makes it easier for the learners to assimilate the information presented to them which can aide in their knowledge construction. In terms of content, the research believes that while there should be elements of structuredness and interaction but the balance should be more in favour of interaction and less towards structuredness.

Student-teacher interaction is different from student-content interaction in that student-content interaction is more about how the course is structured while student-teacher interaction is more about how the two interact. This is interpersonal communication which occurs between the teacher and learner in and outside the context of the study. Teachers play a central role in e-learning effectiveness because they influence the manner in which the students learn, that is whether they develop as independent learners or as teacher dependent learners. It is also argued

that while teacher interaction is essential but too much interaction from the teacher can be counterproductive and can lead to dependency and annoyance.

Student-student interaction refers to the interaction between students. Students in e-learning environment can communicate with each other using synchronous technology or asynchronous technology. Collaborative learning and cognitive participation are discussed as two key aspects of student-student interaction. It is discussed that humans learn socially and hence social interaction should be a key aspect of our pedagogical process.

Student system interaction refers to the interaction between the student and the system which includes hardware and software that the students use to access e-learning content. It is discussed that IT self efficacy is a significant predictor of students' ability to perform in e-learning environment.

Finally the theory of constructivism, which according to the researchers forms the key basis of human learning is discussed. Constructivism is based on the assumption that learners must construct their concepts of the world through observation and active learning and not just by copying or simply absorbing it. According to constructivism, knowledge is not yet discovered and is out there, the learner actually invents and reinvents it over and over as through their interaction with the world. Learners accordingly engage with their environment actively and acquire knowledge through it. Learning is socio-cultural construction and language plays a significant role in our construction of knowledge. Language is a kind of cognitive tool that helps the individuals in deciphering the meaning of the messages conveyed. Constructivists believe in social construction of knowledge and this means that interaction should be the key to developing constructivist skills.

Literature review chapter identified the need to investigate the link between interactivity and e-learning. In particular, it highlighted that the true potential of e-learning can only be achieved only if its effectiveness of considered holistically i.e. not only in terms of the learning of the subject but also gaining the skills of being an independent learner. Past research has mainly focused on looking at learning from the subject perspective however, the researcher believes that, as proposed under theory of constructivism, e-learning is capable of turning every individual into a lifelong learner which is likely to enhance the overall knowledge of the society. In rapidly changing technology based world, individuals may find their knowledge obsolete quite soon. If this happens it would lead to either inefficient firms with employees with outdated skills and knowledge or would lead to individuals struggling to maintain the pace of their professional growth amidst the challenge from younger employees with superior technical knowledge. E-learning can be quite beneficial in such cases because using e-learning the professionals can continue to enhance their knowledge without the need to seek external support or without the need to take time off work to attend formal educational institution. Hence this research is based on the view that e-learning potential of far more significant than what has been utilised by institutions and individuals till now. However, the researcher also agrees that interaction is essential to ensure that quality of learning is not affected in e-learning. The purpose of formal e-learning is to equip the learners with skills to interact with different e-learning elements and construct knowledge independently. Hence this research aims to investigate which aspects of interactivity in e-learning are critical for users to be able to learn the art of constructing knowledge.

This research also posits that if e-learning systems are designed with this knowledge construction objective in mind, it will provide far more significant benefits as compared to the systems which focus solely on teaching subjects. Institutions can then release independent learning courses for individuals who wish to learn independently without entering a formal education network. These independent learning courses could have a significantly positive impact on the overall growth of the human society.

Chapter 4: Data and methodology

4.1 Introduction

Chapter 3 presented a detailed review of the existing literature on the key aspects of this research. The conceptual framework used for this research was also described in detail. From a thorough literature review four types of interactivity are identified in e-learning: Student-teacher, student-student, student-content and student-system. While past research has considered student-system as part of student-content interactivity but the researcher believes that this view narrowly focuses on different kinds of interactivity. Researcher believes that content and system are two different aspects because technology is rapidly changing and this will inadvertently lead to changes in the system. For example, already lot of internet based applications are being moved to mobile platform. With such rapidly changing technology it is essential to consider technology as a player in the e-learning process rather than combining it with content aspect.

Literature review indicates that while many researchers have talked about the role of interactivity in e-learning none of the past researchers have looked at empirically testing this relationship. Furthermore, different aspects of interactivity have not been investigated in sufficient detail. This means that the past research has little practical benefit for those developing e-learning solutions. This research aims to fill these gaps.

Having identified what needs to be investigated this chapter presents detailed review of the methods used for collection and interpretation of data along with the reasons for selecting specific methods. Researchers have an option of choosing one of the several research methods for collection of data, however, certain considerations are required to ensure that data and

methods fulfil the objectives of the study (Collis and Hussey, 2009). These are discussed in this chapter in relevant sections.

The first and foremost issue that the researcher needs to focus on what he/ she is trying to answer. The nature of the research questions has a strong impact on the choice of methods. For this researcher could focus on the keywords in the research questions. This research aims to identify what is meant by 'effectiveness' in context of e-learning. Then it aims to identify how different aspects of interactivity impacts the effectiveness in e-learning and how interactivity in e-learning can be improved in order to improve effectiveness of e-learning. The focus is not so much on technological aspects but rather the actors who actively engage in knowledge exchange in e-learning. For this research the teachers and students were identified as the key participants for the data collection process.

Once the nature of research questions is identified the researcher can plan about data collection taking availability and access to data into consideration (Leedy and Ormrod, 2010). The key consideration in research methodology is selection of the research philosophy. It acts as a guiding tool for selection of the rest of the research elements such as research approach and strategy as well as the data collection tools.

Research philosophy is nothing but researcher's opinion of the truth- does it exist (epistemology) and can it be discovered (ontology). This chapter also begins with a discussion of the research philosophy selected for this research. It provides detailed discussion on the possible research philosophies and their application in context of this research. This will be then followed by a discussion of the research strategy. Finally the data collection tools and how they were applied in this research are discussed.

This research adopts a pragmatist research philosophy which means that he researcher is not restricted to any particular research philosophy and remains independent to select a research philosophy which suits the research. Consequently this research adopts a mixed method strategy. While the quantitative aspect of the research is aimed at generalisation and at establishing the relationship between interactivity and effectiveness of e-learning the qualitative aspect of the research aims to probe this relationship. Data for this research is collected using structured questionnaires and focus groups. Questionnaires are useful in that they provide pre coded answers and could be administered remotely. It is thus a convenient and cost effective data collection tool especially if the sample size is large or if there are other limitations as discussed later in this chapter. According to Hunaiti *et al*. (2009) online questionnaire are cost effective, easy to distribute and analyse and are also environmental friendly. Due to its cost benefits and other issues, as discussed in the relevant section, online questionnaire was used. Focus groups are useful in that it provides the benefits of interviews and discussions without incurring significant costs and efforts. It allows more rich data as users can counter each other's argument and provide data that is rich and useful. Focus group interviews were used after the analysis of the questionnaire surveys as the purpose of the focus groups was to gain insight into questionnaire respondents' views.

4.2 Research Purpose

The aim of this research is to investigate the impact of interactivity on effectiveness of ea-learning in Saudi Arabia. This research is an explanatory research. It not only establishes the link between different kinds of interactivity and effectiveness of e-learning in Saudi Arabia but rather goes a step further and describes how interactivity can influence learning in terms of construction of knowledge. The purpose of this insight is to understand, from learners' perspective, what works and what does not work as far as current e-learning methods are concerned. It is essential because the researcher believes that current e-learning systems are limited in what they aim to

teach, that is, subject not skills. It is essential to explore participants' opinion further in order to understand if researcher's assumptions are true and what can be done to improve the interactivity and effectiveness in e-learning systems.

Creswell (2009) specifies that research process consists of seven steps. The first step involves identifying the problem which involves looking at what could be the potential areas of research. Researcher can use his/her knowledge and experience for this. The second step involves conducting a thorough literature review to identify gaps in the research. This ensures that the researcher enhances her knowledge and at the same time ensures that researcher does not waste his/her efforts in discovering what has already been discovered. After the literature review the researcher can specify the purpose of the research. Researchers can look to fill an existing research gap or achieve a professional objectives or a combination of both. This research aims to not only investigate the link between interactivity and effectiveness of e-learning but also aim to provide practical recommendations on improving the e-learning system as a whole. The fourth step involves developing a strategy to collect and analyse data. This involves considering what kind of data is available and how to best access this data. For example, if the data is perceptual and not factual qualitative methods may be more useful and vice versa. Similarly, if the data is publicly available secondary data collection methods may be useful but if the researcher need to learn from the experts primary data collection methods such as interviews may be useful. In the fifth step actual data collection takes place, that is, implementation of the methods identified in the previous step. This is followed by analysis and interpretation of the collected data. Finally the seventh step involves evaluating and reporting the findings, that is, answering the research questions based on the data.

Based on the different aspects of research designs provided by Creswell (2009) and Saunders et al. (2011), following aspects of the research design have been established for this research

Research Level	Detailed Description
Type of research questions	Which aspects of interactivity have a significant impact on effectiveness of e-learning in Saudi Arabia?
Strategy	Mixed (Qualitative + quantitative)
Paradigm	Pragmatism
Data collection method	Internet survey, focus groups
Participants	Higher education students in Saudi universities
Type of results	Explanatory and Mixed (qualitative and quantitative)

Table 2:   **Overview of research design. Source: Self**

4.3 Research Paradigms (Philosophy)

Different authors, starting with Kuhn (1962) have provided different definitions of the term *paradigm*. Kuhn (1962: 10) defined scientific paradigms as "accepted examples of actual scientific practice, examples which include law, theory, application, and instrumentation together-- [that] provide models from which spring particular coherent traditions of scientific research....Men whose research is based on shared paradigms are committed to the same rules and standards for scientific practice." Harmon (1970: 5) defined a paradigm as "the basic way of perceiving, thinking, valuing, and doing associated with a particular vision of reality." Baker (1992) defined it as "a set of rules and regulations (written or unwritten) that does two things: (1) it establishes or defines boundaries; and (2) it tells you how to behave inside those boundaries in order to be successful."

Capra (1996: 6) defined paradigm based on several other definition as "a constellation of concepts, values, perceptions and practices shared by a community, which forms a particular vision of reality that is the basis of the way a community organizes itself." Broadly speaking a paradigm is a set of rules which the researcher use to define, analyse and investigate an issue. It depends on researcher's view of the reality.

Paradigms are useful in that they lay the foundation for the research allowing the researcher to identify the best methods and approaches to achieve what research aims to achieve. Using paradigms, the researcher can establish the rules which will guide his research. This limits the scope of the research to align with the aim of the research (Huitt, 2011).

Over time period there have been many developments in the field of scientific research paradigms leading to what is known as 'paradigm shift.' This has come with intense debate on the supremacy of different research paradigms and this debate provides interesting insight into strengths and weaknesses of different research paradigms.

Research paradigms are categorised based on three dimensions: ontology, epistemology and methodology

Ontology	Epistemology	Methodology
• Subjectivism • Objectivism	• Historical • Empiricism • Idealism • Rationalism • Constructivism	• Qualitative • Quantitative • Mixed method

Figure 7: Different pillars of research philosophy. Source: Creswell (2009)

Epistemology refers to our opinion of the reality i.e. whether we believe in the existence of the reality or not. Ontology then refers to how we can learn about the reality (Creswell, 2009). Methodology refers to the methods and tools we can use to learn about the reality. It can be safely assumed that these three are linked with each other. For example, positivists believe in existence of a reality which then relates to use of objective methods and quantitative methods for discovering the reality (Creswell, 2009).

On the basis of the three pillars, scientific paradigms can be broadly categorised in the following four categories

- ***Positivism***:   Positivism is based on the epistemological belief of empiricism. Positivists believe in existence of a universal truth which can be discovered by use of scientific methods. Positivists believe in operationalisation of concepts in order to understand those (Creswell, 2009). Using simple units of analysis positivists assume human interests to be relevant but not primary.

  Positivism predominates in science and assumes that science quantitatively measures independent facts about a single apprehensible reality (Healy and Perry, 2000). In positivist research the data and analysis are value-free which means that irrespective of the data collection and data analysis method chosen by the researcher, the findings will remain the same (Healy and Perry, 2000). Since there is only one reality it does not matter how we discover it. This is a common paradigm adopted by researchers in deductive research i.e. to establish relationships, test theories, models, frameworks etc.

  Positivists most commonly focus on statistical tools to come up with verifiable answers establishing their view of the reality (Easterby-Smith et al. 2002). Positivists most commonly rely on objectivist ontology and quantitative methods to discover the reality. These most commonly use large and randomly selected sample in order to increase generalisability of findings.

- *Interpretivism*: Interpretivism is based on the epistemological belief of constructivism. Intrepretivists do not believe in the existence of a truth and contend that truth is nothing but construction of our minds (Creswell, 2009). This means different individuals will hold different views of the truth and hence the view of the truth will depend on who you ask.

Since there is not one reality, the reality will depend on how we interpret it or construct it (Creswell, 2009). Hence the name interpretivism/ constructivism. In this kind of research the onus is on the researcher because the findings will be dependent on how the researcher interprets the data. This is commonly used in inductive research where the researchers is aiming to explore and develop the hypothesis rather than testing an existing hypothesis (Creswell, 2009).

Interpretivism is most commonly used to understand complex human issues where one particular truth different individuals hold different views based on their own knowledge, experience and context. Research which explores the hitherto unknown concepts are particularly suited for interpretivist paradigm (Creswell, 2009). Interpretivists most commonly rely on subjectivist ontology and qualitative methods to learn about the reality. These most commonly use small but effective sample focusing more on richness of data rather than on generalising the findings. What makes interpretivist research quite useful is that it is capable to accommodating divergent and sometimes contradictory perspectives that different stakeholders hold.

- *Realism*: Realism is based on the epistemological belief of rationalism. Realism is based on the assumption that there is a single reality but it is not possible to understand that reality and hence it need to be understood from different perspective (Creswell, 2009). It thus advocates use of mixed methods.

- *Pragmatism*: Pragmatists do not believe in following a particular philosophy and find it unnecessarily binding. They believe that in any given researchers there are multiple

issues, some of which may relate to positivist philosophy and some to interpretivist (Mackenzie and Knipe, 2006). Thus, it will be futile to follow a particular philosophy for the whole research and instead researcher must remain independent of a particular school of thought and use the right methodological approach based on the research question and other factors (Creswell, 2009). Pragmatists do not believe in making assumption and tend to use the approach which is most suited to the situation. According to pragmatists selecting either of the philosophical paradigms limits the choice of the researcher while the researchers should not limit themselves to a particular philosophy but use these on merit i.e. based on each and every research question (Creswell, 2009). Pragmatists, thus, recommend using mixed methods and research designs such as triangulation to come up with best solutions.

Positivism	Interpretivism	Realism	Pragmatism
Single reality and hence discoverable using scientific and objective methods	Multiple realities hence discovery of absolute trust is not possible but rather construction/ interpretation of what constitutes reality is achieved using subjective methods	Single reality but multiple perspectives hence a combination of subjective and objective methods is requires	Based on reality of practical effect of ideas and hence there is no limitations on the use of objective or subjective methods.
Findings are independent of the researcher and hence expertise of	Findings depend on the quality of interpretation of the data and hence	Initially the researcher remains independent as he discovers the reality	Author is independent to use pragmatic approach to discover and

researcher are not critical	researcher must have some expertise to be able to make sense of data.	but may need expertise to explain the reality in context.	explain reality and may take his/her expertise as well as availability of data into consideration.

Table 3: Difference between different research philosophies. Source: Self.

4.3.1 Ontological, Epistemological and Methodological Stand of this Research

This research adopts a pragmatist research philosophy. Researcher believes that truth about learning is context dependent and hence effectiveness of learning is based on our construction. However, it cannot be disputed that certain e-learning systems are more interactive than others and that these systems have a different impact on our learning and construction of knowledge. Thus, despite the divergence in our construction of learning and knowledge there is some convergence in the manner in which we approach it. Furthermore, e-learning is a mass system- the benefit of e-learning is to achieve economies of scale and hence customisation of the e-learning process is not possible. This calls for a positivist approach to e-learning research. However, the researcher believes that the essence of constructivism, which according to the researcher is the main benefit of e-learning, is based on individual standpoints and thus calls for interpretivist standpoint. Since this research aims to look into both these aspect, pragmatist standpoints is considered suitable for this research.

Positivist research is useful when a single truth exists and can be found out. In constructivist learning this single truth does not exist. Positivists have used quantitative measures such as overall grades in the modules as barometer of effectiveness. Oliver and Conole (2003: 389) term this as tendency "to measure what is easily measured." However, researcher believes that such a approach limits the scope of e-learning which is more than learning a course. Ab Jalil (2007)

argues the view that students are always learners and teachers only teach is a limited perspective. Thus, Ab jalil et al. (2008) argues that "an online space, the social fabric is complicated and teaching and learning behaviours are mixed." Anderson et al. (2001) used the term "teaching presence" to signify that online learners not only from their teachers but they themselves also act as teachers. This refers to student-student knowledge exchange as discussed under student-student interaction. Based on these views Ab Jalil et al. (2008) contend that online learning is basically assisted learning which is best understood from a pragmatist viewpoint.

The following aspects support the claim for use of pragmatist philosophy in this research:

- Current e-learning systems are quite limited as compared to the true potential of e-learning. Resolving this issue will require meaningful and practical actions.
- Technological view of e-learning limits its scope. Technology is dynamic and hence underling problems must be understood independent of technological barriers. Understanding interactivity and constructivism independently of technology is essential because new technology will be developed and hence any findings situated in technological context will become obsolete. The purpose of this research is to divert attention of the efforts (to developing e-learning systems) into a direction which will allow achieving of the full potential of e-learning, that is, developing a society comprised of independent and efficient learners.

• Current e-learning systems are quite limited in interactivity and effectiveness o e-learning and that is one primary cause of their low adoption. E-learning research must thus focus on practical solutions to the problems and that is to make e-learning more effective than classroom learning.

• Current lack of research into interactivity and effectiveness of e-learning (in terms of constructivism) requires a pluralist approach as supported by pragmatic philosophy.

This research adopts mix of subjectivist and objectivist ontological standpoints. Combination of the two is supported by pragmatic philosophical standpoint. The subjectivist ontology is useful in understanding the essence of learning that is, how learning is shaped by different forms of interactivity. The objectivist ontology, on the other hand is useful in establishing the relationship between different forms of interactivity and effectiveness of e-learning independent of the personal biases of any of the respondents. This will also help in testing Anderson's interaction equivalency theorem that one kind of interaction can balance other forms of interaction. Researcher's assumption is that if the true objectives of e-learning, that is learning the skills of knowledge construction, is to be achieved all forms of interactivity are critical. This is so because learners will require whatever possible support they can achieve as independent learners to make their learning effective. These skills can only be acquired if all forms of interactivity are achieved in e-learning.

Following the pragmatist philosophical standpoints this research adopts a mixed methodology. Mixed methods allow selection of multiple methods which helps to achieve the objectives of understanding diverse views and assumptions, using different methods of collecting and analysing data (Creswell, 2009).

4.4   Research Approach

Research approach is chosen on the basis of whether the research is testing an existing theory/ model/ framework (deductive) or developing a new model/ theory/ framework (inductive). The differences between inductive and deductive research approach are listed in the table below:

Deductive approach	Inductive approach
• Mainly used in scientific studies.	• Aimed at developing a new theory/

• Tests existing theory/ model/ framework.	model/ framework.
• Mainly tests causal relationships;	• Suitable for social science research looking at human perception and behaviour.
• Validity of data is critical.	• Research process if flexible.
• Researcher is neutral to the process of collection and analysis of the data	• Researcher is an active participant of the research process
• Data collection and analysis is done in structured manner	• Quality of findings somewhat depend on the knowledge and skills of the researcher.
• Researcher remains independent of the research.	• Research context is critical as findings are applied in context and are not generalised.
• Findings can be generalised across the population.	•

Table 4: Deductive V/s Inductive Research Approach. Source: Saunders et al. (2011)

Inductive research is often used in social sciences research where the purpose is to understand the perceptions and behaviour of individuals. In this respect this research confirms to inductive approach. This research does not use an existing framework for exploring interactivity and may be suitable for inductive approach (Yin, 2009). In case of inductive approach the intention is to develop a new theory/model/framework (Saunders et al., 2011). However, as so often happens the findings are quite contextual in the inductive approach based research. Researchers can use a number of case studies or some other decontextualisation approaches in order to generalise the findings (Collis and Hussey, 2009).

Deductive approach, on the other hand is about applying existing theory/framework/model to a new context in order to test its applicability (Saunders *et al*. 2011). In this respect this research also supports deductive approach as it involves application of theory of constructivism in context of e-learning in higher education institutions in Saudi Arabia.

However, considering the fact that effectiveness is measured using an existing theory but a novel approach is adopted to evaluate interactivity, this research seems to support abductive approach which is essentially a combination of inductive and deductive approach. This research utilises an existing theory to build a novel conceptual framework and hence it can b best described as abductive approach. Pragmatist philosophy also supports the use of abductive approach.

4.5   Data types

There are primarily two kinds of data types that the researcher can use- secondary and primary. This research utilises both primary and secondary data. Various aspects of data collection are described in detail below.

4.5.1 Secondary data

Secondary data is the existing data which can be used for the research with any modifications, if required. These are quite useful in hat the researcher can make use of existing data thereby minimising his/her efforts in data collection. These are quite commonly used in medical field and in other studies where it is logically not possible for the researcher to collect the data. For example, every few years governments around the world carry out cohort studies surveying almost every household in the respective countries. This is a large scale data, publicly available, mostly for free. It is logistically and financially not possible for ny researcher to collect such large scale data for any research and in such cases using this secondary data is extremely useful.

However, there are significant issues with secondary data. Firstly, secondary data is the data collected by someone else for some other purpose. Hence the data may not suit the requirements of the research and modifications may be required. Such modifications may render the data useless. Also the methodology for the secondary data may not always be clear and anyone using the secondary data will adopt the inherent flaws in the data collection strategy. For example, in countries like Saudi Arabia, if the data was collected by males then it is most likely to be biased because majority of females will not interact with any unfamiliar males. This means that male data collectors would mainly involve male respondents thereby creating a bias in the data. Also the timing of the data could make it irrelevant. For example, if data is collected about popularity of apolitical party, this would become quite irrelevant in future as popularity of political parties will swing with development in overall socio-political environment. Thus, the researchers looking to use secondary data must focus on its relevance with the research, in all respects, before deciding to use it.

However, it can be argued that almost all research use secondary data to certain extent in their research in forms of literature review. Existing literature is a form of secondary data as it provides insight into subject under study. This research utilises secondary data in forms of literature on subjects such as e-learning, interactivity in e-learning, constructivism, e-learning models etc. Existing literature on these subjects was collected and analysed in order to carry out an extensive literature review which informed the researcher of the key themes in the subject area. It was also used to identify the research gaps and corresponding research problem.

The primary focus of this research is on improving effectiveness of e-learning through enhancement of interactivity in e-learning. Extensive literature is available on interactivity in e-learning as well as on constructivism. However, no research was found which empirically tested the link between e-learning interactivity and its effectiveness based on the principle of constructivism. This research gap was identified through an extensive review of the existing literature only. Based on the findings of the literature review, a conceptual framework was developed.

Sampling for secondary data: Secondary data was used for qualitative research in this research. In line with qualitative methods, a combination of theory-based, convenience, and purposeful sampling strategies were adopted (Miles and Huberman, 1994). The sampling involved the research articles with key words "e-learning", "interactivity in e-learning," "constructivism," "effectiveness of e-learning." E-learning is about using online material for learning and in this respect this research are quite naturally aligned with the use of existing research for learning about different aspects of the research.

Reliability of sources was a concern for the researcher. In order to overcome this she collected papers published on high ranking journals only. Using this approach allowed the researcher to find information from well referenced and well renowned authors. In addition, data about developments in e-learning in Saudi Arabia were obtained from government websites.

4.5.2 Primary data

Primary data is the data collected by the researcher himself for the purpose of the research. In this respect the researcher has complete control over the data collection process. For example, the researcher can decide when and where to collect the data from, who will be the participant and how much data will be collected.   Since the researcher is best aware of the data requirements of the research, his/ her control over the data collection process means that the data collected is high quality (Saunders *et al*., 2011). Researcher can use one or more data collection tools from the range of data collection tools available including but not limiting to questionnaire surveys, interviews, focus groups, observations, participation etc. Since the data collected is specific to the research it is more relevant to the context of the study.

This research uses questionnaire surveys and focus groups as primary data collection instruments. These are discussed in detail later in this chapter.

4.5.3 Quantitative, Qualitative and Multi-method Research Methods

Research methodology is the overall strategy used for the collection and analysis of data. It has strong link with the research philosophy (Dainty, 2008). Research methodology involves developing a strategy for collection and analysis of data. It mainly derives from the philosophical paradigm: If the researcher believes in existence of the truth/reality, the best approach is to use quantitative methodology in order to establish the reality. If the author believes in multiple realities, qualitative methodology is most suited so as to understand all the perspectives on the reality (Fellows and Liu, 2008). When the researchers believe in single reality but multiple perspectives of that reality then mixed methods are used first to establish the reality using quantitative methods and then understanding the different perspectives of that reality using qualitative methods (Fellows and Liu, 2008).

Research methodology can be broadly categorised a qualitative and quantitative but a third category, mixed methods, which is a combination of qualitative and quantitative methods also exists. Quantitative research is often deductive in that it begins with an existing theory /hypothesis which is tested in context of the research (Creswell, 2009). On the other hand, qualitative research are often inductive in that they are generally not preceded by existing theory/framework (Creswell, 2009).

Qualitative research is open ended and offers the researcher ability to explore without limitations, however, this can also lead to ambiguity and lack of clarity on what the data is trying to reveal. In such cases, the qualitative research can provide divergent results and may fail to answer the question (Kothari, 2008). For example, in interviews, different individuals may express completely contradictory views leading the researcher ambiguous findings. On the positive side a limited number of respondents may be sufficient to reveal rich insight into the phenomenon the researcher is trying to find.

Quantitative methods are generally used when there is a large amount of data is available for statistical analysis. It helps in generalising the findings. One of the key benefits of quantitative data is ease of collection of data and analysis. Since the data is objective, it is easy to verify the data and even the findings i.e. different researchers, using the same sample should arrive at similar findings. Quantitative research often leads to accurate findings but the accuracy often depends on the sample size. However, quantitative research may not be suitable to explore phenomenon with little prior insight and is often limited in scope. Quantitative research is often used when generalisation of findings is required while qualitative research is often useful when context of the study is important.

Qualitative methodology is often used when the purpose is to study a problem in its context as qualitative methods allow capturing the context. Qualitative data can be quite hard to collect though a small amount of this may be sufficient. Also the quality of the findings depends on researcher's ability to make sense of the data (Creswell, 2009). Since different individuals may have different perspectives, their interpretation of the data could differ leading to different findings. In order to overcome this, there is an increased use of scientific methods to analyse qualitative data; for example, the increased use of qualitative data analysis software such as Nvivo and Atlas.

Mixed method research aims to benefit from both and the researcher is independent to use either based on the situation (Saunders et al. 2012). Onwuegbuzie and Daniel (2002) goes as far as suggesting that no research is pure quantitative or qualitative. Mixed methods combine qualitative and quantitative methods in order to achieve multiple objectives. Using the combination of the two allows the researcher to make the best use of the two types of methods. Mixed methods follow the pragmatist approach and leave the researcher open to use any method depending on the nature of the question and availability of data. It allows the researcher to overcome the shortcomings of one method with the strengths of the other. For example, researcher can investigate relationships using quantitative methods and use qualitative methods to reflect on the nature of relationships.

This research adopts a mixed methods approach. Mixed methods are considered useful in e-learning research. For example Ab. Jalil et al. (2008) argue that the multiple perspectives in e-learning are best investigated using multiple methods as envisioned in pragmatist philosophical standpoints. As was mentioned in the research philosophy section, use of multiple methods is central to this research because it does not only investigates how interactivity influences effectiveness of e-learning but also why.

Traditionally the e-learning researchers have focused mainly on quantitative methodologies. There are several reasons for this such as generalisability, validity, reliability etc. however, Zimmerman (2005) argues that learning is contextually bound and is influenced by the learning environment and hence supports the use of qualitative research in e-learning. Similarly, Marton and Booth (1997) argue that in order to understand the effectiveness of e-learning from student's perspective it is essential to ask the students about their experiences. Isolating the individuals who are the ultimate beneficiaries of the learning process is not wise. Järvelä (2001) and Turner (2001) speak of the paradigm shift in e-learning as the researchers understood the significance of context and consequently started to apply a "range of multilevel approaches and methods for investigating subjective and dynamic processes related to the context of learning" (Järvelä, 2001: 7). According to Hodkinson and Macleod (2007) "specific research methodologies usually have strong affinities with different conceptualisations of learning. No methodology can act as a conceptually neutral lens, transparently revealing what learning is."

Considering the aforementioned arguments use of multilevel mixed methods design was considered most suitable for this research.

4.6   Quantitative method – questionnaire survey

The primary data collection for this research began with questionnaire survey. The questionnaire survey was conducted with higher education students studying in Saudi Arabia and was designed to investigate their perception of how interactivity affects effectiveness of e-learning.

Questionnaire surveys are most commonly used data collection tools in quantitative research. There are primarily three kinds of questionnaire surveys: open, structured and semi structured. Open ended questionnaire surveys are partly like qualitative research where the respondents are free to register whatever responses they have. Such questionnaires are insightful as it allows the respondents to provide detailed responses but at the same time data obtained from such questionnaires are difficult to compile and analyse (Fisher, 2007). These are commonly used where the researcher wishes to collect detailed responses but cannot obtain access to the respondents for direct data collection. In structured questionnaire surveys, responses are pre coded and the respondents have to select one of the given responses for each question. These are less time consuming and are less costly to administer. Also the data is easy to collect, compile and analyse (Fisher, 2007). However, such surveys are less insightful and primarily used for testing frameworks. Semi structured questionnaires area mix of the open and structured questionnaires. Here the respondents are given some pre coded responses but have the option of entering a response different from those given. It provides the benefits of the both insight as well as low level of effort required to compile and analyse the data.

Literature review chapter resulted in the initial conceptual framework designed to establish link between four different types of interactivity with effectiveness of e-learning. The purpose of the quantitative part of this research is to test this conceptual framework in order to establish the link between different kinds of interactivity and effectiveness of e-learning. The purpose of questionnaire here is to generalise meaning a large number of responses will be required. In this respect, it is essential to use closed/ structured questionnaire survey for this research.

Questionnaires have several benefits. For example, questionnaires can be self-administered meaning the respondents can fill in the questionnaire from where they want and when they want. This means the respondents will be independent of researcher's intervention in any respect and this could improve the reliability of responses. However, this would depend on whether the responses are collected anonymously or else the respondents may reserve their opinion on the issues which they feel could embarrass themselves or their employer. Also lack of researcher's intervention means that responses could not be verified. Thus, if the questionnaire is inaccurately designed or the questions are ambiguous, the respondents will either not respond to the question or will answer incorrectly. There are several ways of improving the design of the questionnaire as discussed later. In short, pilot surveys could help the researcher in identifying and rectifying such errors. Also the researcher can provide as much details as possible along with sample responses to help the respondents understand the question.

Questionnaire surveys are also plagued with poor response rate. Generally a response rate of around 30 percent in a randomised sample is considered good (Saunders et al. 2011). Despite this limitation, it is possible to generate a large number of responses through questionnaire survey because it minimises respondents' time and effort investment.

Questionnaire survey was considered useful in this research because of the following points:

- It increased the number of responses allowing a meaningful statistical analysis.
- Researcher could adopt a randomised sampling allowing the researcher to collect data without any sample bias.
- Researcher is based in United Kingdom and could only visit Saudi Arabia for a short duration during which she could not have collected a lot of data. Questionnaire survey in this research was administered only using the website surveymonkey.com. Researcher kept the survey online for a duration of four months allowing her to generate a high level of responses which were essential to achieve high level of reliability in the findings.

- Researcher is also assured of the reliability because remote administration of questionnaire survey would have motivated respondents to provide true and accurate responses without any fear or pressure.
- This is academic research which is limited in the funds that the researcher has at her disposal. Online administration of questionnaire allowed her to keep the costs to minimal.
- Compiling of the resources was easy. All the responses were downloaded in an excel file at the end of the survey and the data was then transferred to SPSS software for statistical analysis The whole process took less than 15 minutes.

4.6.1 Questionnaire Review and Development Process:

The questionnaire survey as primarily divided in five parts. The first four parts looked at the four kinds of interactivity and the fifth part looked at the effectiveness of e-learning. Effectiveness section was divided in three sub parts, namely, course outcomes, independent learning skills, learning behaviour. These constructs and relevant questions were formed on the basis of the knowledge gained through the extensive literature review. The different themes used in designing of the questionnaire are briefly discussed below:

Student-teacher interaction: This theme investigated the extent to which interaction with the teachers help the students in developing knowledge of the subject as well as skills to become an independent e-learner. This involved the assistance and support aspects of teaching. This also looked at the different kinds of interaction from instructionism to participative teaching.

Student-student interaction: This was another social interaction included in this questionnaire. Questions in this section related to how interaction with peers helps in building knowledge of the subject and skills of using e-learning independently. This interaction means not only interaction over the subject but also social interaction. Students were asked questions such as if peer interaction as available and did peer discussion help in their learning. Also students were asked questions about how confident they feel in approaching stranger experts online and asking questions about a relevant subject/ topic?

Student-content interaction: This particular section included questions over whether students felt that the course was organised in an interactive and useful manner and that whether the content presented online was useful. Respondents were asked whether they are able to access the content independently as a result of their e-learning experience.

Student-system interaction: This was more about technology side of e-learning whether the student found the interface and other tools easy and intuitive to use. The primary question was whether they could use other systems without assistance as a result of their e-learning experience. Also whether the system itself made it any easy for the students to access e-learning content.

Effectiveness of e-learning: This was the primary outcome variable in the questionnaire. This section was further subdivided in three sections. *Course outcomes* referred to information about whether students were satisfied with their learning from e-learning, that is, whether they think they learnt about the subject being taught. *Independent learning skills* referred to whether the students gained knowledge of learning something independently online. *Learning behaviour* referred to whether the students are likely to learn something online in future. Respondents were asked questions not only about their learning of the subject they were studying but also whether they have continued to learn independently or are considering doing so in future.

4.6.2   Questionnaire development process

As mentioned before questionnaire was administered online and the researcher had little interaction with the respondents. Because of this lack of interaction it was not possible for the respondents to clarify any doubts they had. This increased the possibility of poor response rate or inaccurate responses. In order to overcome these it was essential for the researcher tod design the questionnaires appropriately so as to minimise the possibility of poor response rate or inaccurate responses.

According to Giesen, Meertens, Vis-Visschers and Beukenhorst (2012), the primary purpose of designing appropriate questionnaire is to ensure that the respondent:

-   understand the questions
-   be able to respondents independently
-   be willing to do so.

The figure below shows the questionnaire development process adopted for this research:
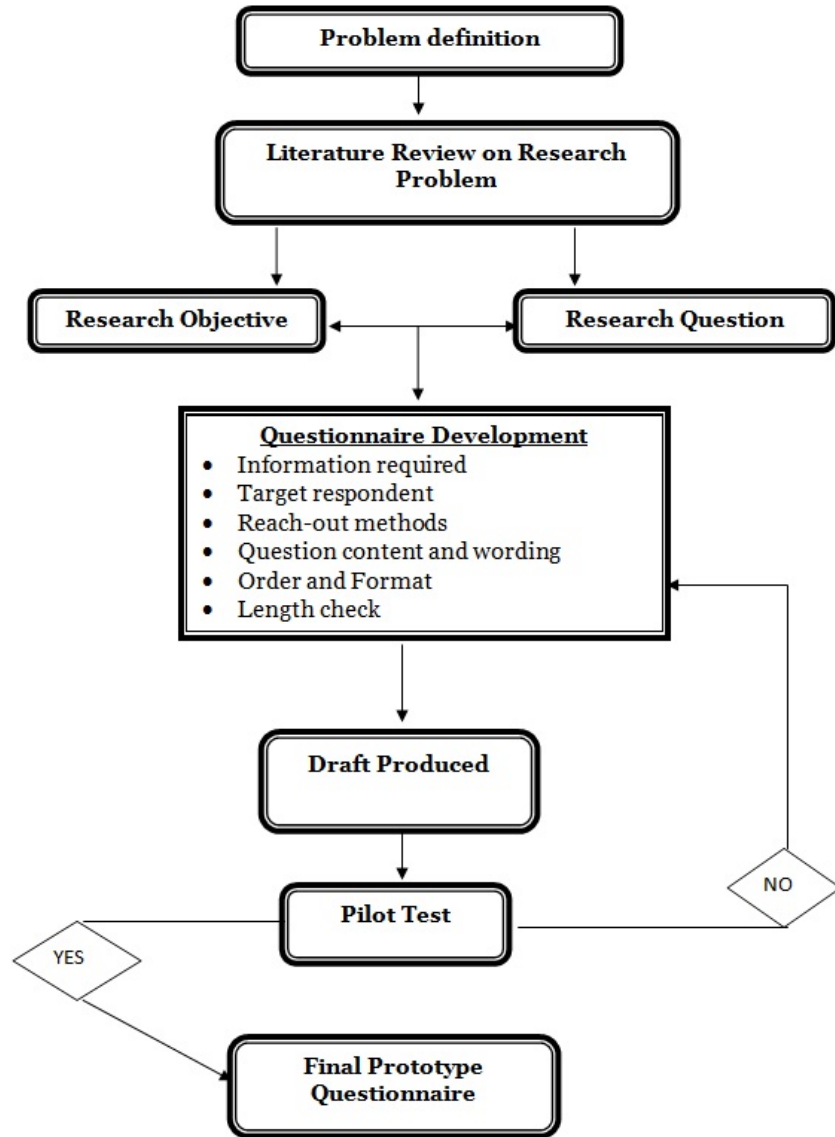
Figure 8: Questionnaire development process. Source: Churchill and Iacobucci (2002); Moore and Benbasate (1991)

Step 1: Information required: Research problem for the research was defined in chapter 1.The key problem that this research aims to answer is to identify which kinds of interactivity are critical to improve effectiveness of e-learning. After a thorough literature review four different kinds of interactivity were identified. Also it was identified the effectiveness of e-learning can be best investigated from a constructivism perspective. Thus the information sought was how the

four kinds of interactivity identified influence the constructivist learning in Saudi higher education institutions.

Step 2: Target respondents: The Saudi higher education students who are either studying or have recently graduated from Saudi higher education institutions and who have used some degree of e-learning during their course were the target respondents for this research. It was considered essential that the respondents have had some experience of e-learning in their studies as the questionnaire was largely reflective on their e-learning experience.

Step 3: Reach out methods: It was considered best to reach out to the respondents using online survey method. Since the intended respondents have had experience of using e-learning, filling online surveys was not considered to be problematic for the respondents. Also online surveys require less efforts and allow the researcher to reach out to a large number of students (Yin, 2009). It was essential considering poor response rate in questionnaire surveys.

Step 4: Question content and wording: Question content as quite critical in this research because of the ambiguous nature of certain terms included in the research. It as essential that the respondent clearly understood the question and that he provided the answer as expected by the researcher (Giesen et al. 2012). In order to do so the researcher chose to ask longer questions to provide as much detail as possible. In certain cases, sample responses were also provided for the respondent to understand what sort of information was sought. The question wording and content was refined on the basis of pilot survey that the researcher carried out. Researcher carried out pilot survey with 25 individuals in her social network. These are the students studying who have done their bachelor's or Master's from Saudi Universities are currently studying Master's or PhD level in reputed UK universities and have significant experience of e-learning and Saudi higher education system. The pilot survey was administered online just like the actual survey and the respondents were asked to provide their feedback on all aspects of the questionnaire including wording, content, design, layout (Giesen et al. 2012). They were also asked for their suggestions

of any questions that might be relevant to this research but has been overlooked by the researcher (Giesen et al. 2012). Questionnaire was reviewed on the basis of the feedback received and re-administered to the same group of respondents to see if they had further feedback.

Step 5: Order and format: Sequence of questions was made random and the responses were also rearranged so that some questions had affirmative tone while some random questions had a negative tone (Giesen et al. 2012). The purpose was to ensure that the respondents read each and every question and answer it accurately rather than respond in a pattern. This is a common problem with self administered questionnaire surveys as respondents try to cut down their time by filling out responses in a particular pattern without reading the question appropriately. If any such issue was spotted it would be dealt with the outlier analysis as described under data analysis.

Length check: Finally the length of the questionnaire was checked to ensure that it was not too long (Giesen et al. 2012). Long questionnaire have a low response rate. Thus, questions such as demographics which were not relevant to this research were excluded from the questionnaire only the questions which helped in answering the research questions were kept. Also for statistical analysis purposes it was ensured that each variable had at least three questions.

4.6.3   Questionnaire structure

The questionnaire contained 34 questions divided in 7 sections as mentioned in the table below

Construct	Number of questions	Nature of questions
Student-Student interactivity	5	Does the e-learning system promotes peer interaction for example by team working, knowledge exchange etc.
Student-teacher interactivity	6	Does the e-learning system allow better and more effective interaction between students and teachers?
Student-content interactivity	4	Is the content included in e-learning interactive? Can the students manage their own learning by using the system?
Student-system interactivity	7	How effectively is the whole e-learning system managed? Is the course designed to be taught using e-learning approach.
Course outcomes	4	Has the student learned about the subject being taught in e-learning? How effective has been the course in developing student's knowledge about the subject?
Independent learning skills	6	Has the student gained sufficient e-learning skills to learn independently using online sources? Can the students search for relevant information online, filter out the most relevant content and analyse the content available online? Is the student aware of aspects such as reliability and validity of information available online?

Learning behaviour	4	Is the student likely to continue learning online in future? Has the students perception towards online learning improved? Is the student likely to update his/her knowledge using online sources in future?

Table 5: Questionnaire construction.

4.6.4 Sampling

Babbie (2010: 173) define sampling as "a method of selecting some part of a group to represent the entire population." Strydom and Venter (2002: 198) refer to sampling as "taking a portion of that population or universe and considering it representative of that population or universe."

Sampling is an essential aspect of any research because researcher cannot collect data from the whole population. It is thus essential for the researcher to identify a representative sample which represents the whole population (Fisher 2007). Accurate sampling is required to ensure that there is no bias in the data and that the sample represents the whole population. The figure below shows the various types of sampling strategies that could be used in a research:
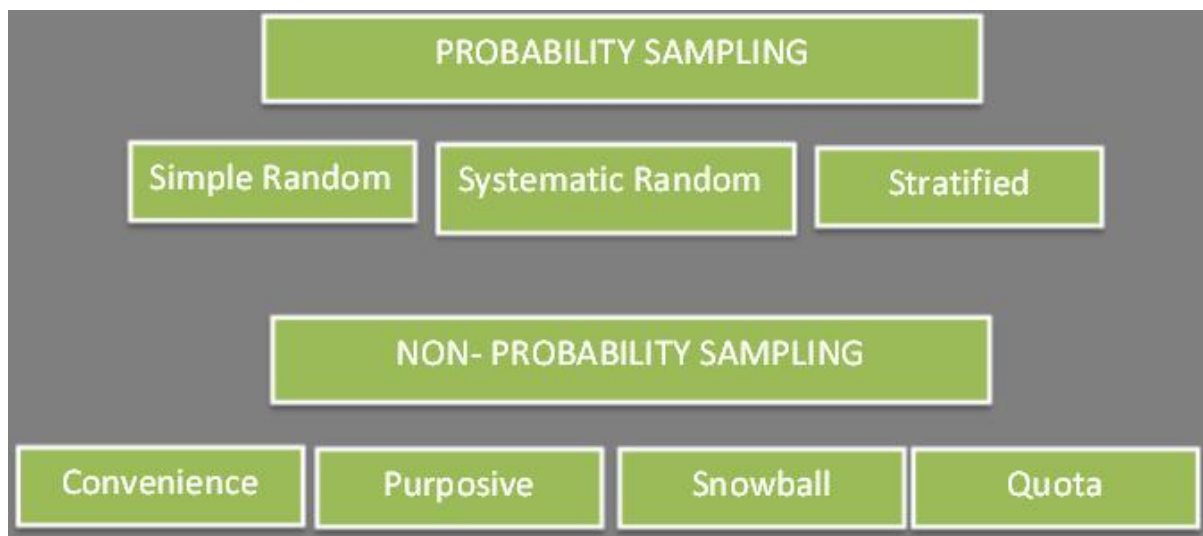
Figure 9: Types of sampling strategy.

This research adopts a purposive sampling strategy. Purposive sampling strategy is a king of non-probability sampling in which the researcher selects the sample based on certain criteria (Babbie, 2010). In this research it was essential for the researcher to collect data from individuals who have had experience of e-learning in higher education institutions in Saudi Arabia. In order to increase the sample size, researcher included the individuals who are currently studying in Saudi higher education institutions and the students who have recently (within last 2 years) graduated from these institutions and have had experience of using e-learning.

Another key consideration for the researcher was the sample size. It is essential that the researcher selects a sufficiently large sample in order to achieve the objective of generalisation of findings. Fisher (2007: 190) provides following estimates for the minimum sample size for a research based on the margin of error of findings.

	Margin of Error			
Population	**+5%**	**+3%**	**+2%**	**+1%**
Around 100,000	383	1,056	2,345	8,762
Around 200,000	383	1,056	2,345	8,762
Around 1,000,000	384	1,067	2,395	9,513

Table 6: Estimating margin of error on sample survey results. Source: Fisher (2007)

According to Saudi government estimates around 1 million students are currently studying at Saudi Universities. Considering this as target population and considering a 5 percent margin of error it was estimated that the minimum sample size required would be 384.

4.6.5 Administering the Questionnaires

This research involved online questionnaire survey. Researcher posted the survey online on surveymonkey.com. The link to the survey was then sent to the people in researcher's social network who the researcher knew met the criteria for participation in the survey. Researcher also contacted people through Saudi student groups and asked people to provide references for other individuals they know who qualify for participation in the survey. In addition, the researcher also contacted the relevant authorities in four of the Saudi higher education institutions and sought their support for the questionnaire survey. Researcher's rapport with some of the teacher (due to her experience of working as a teacher in past) helped the researcher in getting support from the administrative authorities in the universities. These universities were selected because they are the four Saudi universities running full e-learning courses for students.

Researcher kept the survey open for four months to generate maximum number of responses. Respondents were sent two reminders at space of 1 month asking them to fill the survey of they have not already done so and ignore the message of they have already completed the survey.

Respondents had the choice of filling in the questionnaire in one sitting or in multiple sittings but the session expired as soon as the browser window was closed. Respondents were advised to not close the browser window once they have started filling the questionnaire until they finish completing it. Respondents also had the choice of going back to a question and respondents were asked if they would like to review before submitting the questionnaire. Upon completion of the

survey all the responses were downloaded from the surveymonkey website in excel format and exported to SPSS software for statistical analysis.

4.6.6 Quantitative Data Analysis

The benefit of quantitative data is the number of ways in which it can be analysed. There are various statistical tools available to analyse the quantitative data. However quantitative data analysis involves more than statistical analysis. Firstly the data has to be arranged so that it can be analysed statistically. Here the key consideration is what the research question is. The arrangement of the data should be so that it answers the research question. Then follows the statistical analysis which is then followed by interpretation of the analysed data.

Data from the questionnaire survey was uploaded into the SPSS software. Following this the responses were rearranged to eliminate any randomness that was used in the questionnaire survey to ensure that the responses were valid and that the respondents had actually read the question in order to answer.

Following this two tests were conducted to make the data ready for analysis.

Missing values: The first test was to identify missing values. In case any respondents had more than 10% missing responses (that is, if the respondent failed to answer at least 90 percent of the questions) the whole response set for that respondent was dropped (Schlomer, Bauman, and Card, 2010). In cases where missing responses were less than 10 percent of the total questions, the missing response was replaced by the average of the remaining responses for that particular question (Schlomer et al. 2010). There are other approaches for determining the best

value to replace the missing value but mean was considered the most suitable approach because of the following reasons:

- it was easy to estimate
- it is a relatively simple and logical replacement.

Outliers: The second data preparation test conducted was the outliers test which was conducted to ensure that there are no outliers in the responses. Outliers occur when the respondents have misunderstood the question or when they have randomly answered the question without reading it. Either way it is essential to sort out the outlier issues. Generally in 5 point likert type scales any response outside the limits of mean ± 2 is considered an outlier and in 7 point likert type scale any response outside the limits of mean ± 3 is considered an outlier. 5 point likert type scale criteria was used to identify the outliers in this research (Kreuter, 2013).

After identifying the outliers, the values were replaced with the nearest value within the limit. Although other alternative approaches such as maximum likelihood approach or mean replacement approach can also be used but the researcher believes that replacing with the nearest within limit value provides minimum distortion to respondents' response if he did intend to report the outlier. Either way the number of responses with outliers was only 11 which would have had minimal impact on the overall findings.

Once the data was sorted and arranged linear regression analysis was carried out to test the structural model. After obtaining the results the findings were analysed. Analysis was carried out in view of the findings of the literature review.

4.7   Qualitative research

Several researchers such as Zimmerman (2005); Marton and Booth (1997); Järvelä (2001) and Turner (2001) argues in support of the use of qualitative research in e-learning. According to them learning is contextually bound and in order to understand the effectiveness of e-learning from student's perspective it is essential to ask the students about their experiences. This research also aims to understand learning from the perspective of the students and hence following the recommendations of the aforementioned researcher qualitative data is included in this research. Qualitative data for this research was collected using focus group surveys which are discussed below.

4.7.1 Data collection method-   Focus group

Focus groups are a kind of qualitative data collection tool in which the researcher gives the respondents a question to discuss about. The researcher thus guides the agenda for the discussion while recording (in written, audio or video format) the discussion (Barbour, 2007; Jupp, 2006). The benefits of focus group are as follows:

- Because it involves more than one participant a cross verification of responses is done simultaneously
- Unlike interviews where the researcher and respondent engages in one to one discussion focus group involves collecting similar type of data but including several respondents at the same time.
- It is conducted in a social environment and is less formal. This means it is less stressful for the respondents but at the same time there is also a risk of it turning away from the main focus of the research. If that happens it is the researcher's responsibility to bring the discussion back to the agenda.

Focus groups have been extensively used in e-learning research especially those related to improving quality of e-learning. Bichsel (2013) in her research titled "The State of E-Learning in

Higher Education: An Eye toward Growth and Increased Access" used focus group survey for data collection. Similarly O'Driscoll et al. (2010) carried out a research for the University of Surrey examining how can the University use e-learning to improve the learning experience of non-traditional students? They used focus group survey to obtain data from studnets and staff members. According to O'Driscoll et al. (2010: 25) "focus groups are a recognised tool for elucidating rich personal data from participants through the 'explicit use of group interaction' to produce data and insights. Respondents are able to agree or disagree and develop themes introduced by other group members during the group discussion and interaction; there is no compulsion to reach consensus and additionally no participant is required to contribute."

Once the questionnaire survey was completed and quantitative data analysed, focus group survey was carried out to understand the findings of the questionnaire survey in detail. The main purpose of the focus group was to understand how constructivist learning occurred through e-learning interactivity and how interactivity could be improved in order to improve constructivist learning in e-learning.

4.7.2 Conducting Focus Group Sessions

Focus group was conducted in six stages:– questions formation, group preparation, data collection, data preparation, data analysis and interpretation (Onwuegbuzie et al., 2009).

4.7.2.1 Questions formation: The questions used in the questionnaire survey were used to form the questions of the focus group. However, researcher was quite selective in the questions used for the focus group due to the difference in nature of responses. One question was prepared for each construct. The purpose was to guide the conversation during focus groups and not control it. Thus the researcher prepared an initial set of 7 questions which were used of each focus groups. However, researcher did ask some secondary question on ad hoc basis to extract more detail.

4.7.2.2 Group preparation: This stage began with identifying the potential respondents for the focus groups. Researcher sought the help of her contacts in Saudi higher education institutions to identify potential respondents and contacting those respondents to invite them to participate in the focus groups. With the help of her contacts the researcher obtained details of 102 individuals who could be useful for this study. Usefulness of the respondents were determined by their experience of teaching e-learning courses. Only teachers who have taught e-learning courses were invited for the focus group. In total, the researcher invited 102 individuals in four educational institutions. However, only 47 individuals agreed to participate in the focus group. The researcher then contacted them asking them of the date and location that will be most convenient to them. In total the researcher arranged for 6 focus groups, 5 containing eight members each and one containing seven members. The purpose of this arrangement was that even if there were a couple of absentees, researcher would still be able to carry out the focus group with the remaining respondents. Main objective was that despite the absentees each focus group should have at least five participants.

Focus groups can contain anything between 5 to 10 respondents. Ay more respondents than this means that the focus group could be too crowded meaning not all the respondents would get opportunity to talk (Onwuegbuzie et al., 2009). It is essential that the composition of the focus group is homogenous to ensure that there are no communication and other kinds of problems. Homogeneity of the group also ensures that none of the members felt intimidated of humiliated by rest of the team members.

Once the preferences of the participants was obtained the researcher arranged those in groups so as to best allocate the time and place of their choice. Out of forty seven participants 6 could not be allocated their desired place or time and they were humbly requested to participate in any other group with lower group number. At the end of the exercise researcher was able to allocate all participants to the groups of their first or second choice. Finally the group composition was

that three focus groups had nine members, one group had eight members and two focus groups had six members.

All the respondents were sent the details of the focus group including a sample of the questions that will be discussed. This was to ensure that the respondents came prepared knowing what to expect.

All the forty seven respondents who agreed to participate in the focus group turned up for the discussion .Following was the composition of the focus groups:

Focus group #	Number of participants	Educational Institution	Duration (minutes)
Focus Group #1	9 individuals	Institution #1	73
Focus Group #2	6 individuals	Institution #2	49
Focus Group #3	8 individuals	Institution #1	51
Focus Group #4	9 individuals	Institution #4	62
Focus Group #5	9 individuals	Institution #3	79
Focus Group #6	6 individuals	Institution #4	53

Table 7: Details of each focus group

All the focus groups were conducted in English language but the respondents had freedom to use Arabic if they felt comfortable because all the respondents and the researcher were bilingual in Arabic and English.

Guidelines mentioned by Krueger (1998) were used to structure the focus groups. At the beginning of the focus group the researcher introduced herself and requested each participant to introduce themselves. Focus group began with a brief introduction of what the research is about and what the researcher is trying to find. In particular researcher explained what he meant by effectiveness of e-learning and provided an overview of constructivism. This part took around 5 minutes. Following this the researcher proceeded with asking specific questions. Once all the questions were covered the researcher closed the focus group with a summarising and closing question followed by a note of thanks.

4.7.3 Data Collection

Each session was audio recorded with the permission of the respondents. In addition the researcher sought the services of a short hand typist who took notes during the focus group. At the end of each focus group the typist and the researcher recreated the focus group transcripting each and every aspect of the focus group including the respondents who were identified by numbers.

4.7.4 Data analysis

In total 367 minutes of audio recording was obtained. This was transcripted, compiled and merged together. The merged data was then arranged under the five themes – the four kinds of interaction and effectiveness. The data was then analysed qualitatively. Researcher interpreted the meanings by arranging the data in contrasting viewpoints that they presented.

Based on the findings of the focus group the findings of the questionnaire survey ere explained. This was also compared with the findings of the literature review to evaluate whether the findings of this research supported or contrasted the findings of the literature review.

4.7.5   Hardware and software Employed

A Sony voice recorder as used for audio recording of the focus groups. In addition the typing assistant used a laptop to both audio record the conversation as well as prepare notes of the focus group discussion. Both the devices provided the audio recording in the mp4 format. In addition the researcher used her iPhone 5 for audio recording. All three decided used were placed at three different sides to capture audio from all angles. The purpose of using a number of devices to ensure that complete focus group was recorded and that another source could be used to clarify when the recording from one source was not clear. For transcription purposes the researcher used Dragon Speech recognition software. This software allows conversion of audio to text.

4.7.6   Limitations of Focus Group Discussions

As discussed before the focus group surveys can have several limitations. Dynamic interaction between the respondents is essential for achieving the benefits of focus group surveys. However, there is a strong likelihood that certain members of the focus group are perceived to have higher

"expert power" due to their personality, talking style, knowledge, education or some other factor (O'Driscoll et al. 2010). When this happens the other members of the focus group my retreat partially or completely and the focus group becomes the contribution of the expert member only. Some respondents may not talk due to fear of offending others as their views may be contrary to a member or the rest of the group (O'Driscoll et al. 2010). In any case, it s the responsibility of the researcher to ensure that every participant have had the chance to speak. In certain cases, it is considered useful to raise contradictory arguments just to see if there is any support for the arguments contrary to the popular arguments. Researcher used this approach to ensure that any contradictory opinions are also covered in the focus group. Researcher also kept an eye on the members who spoke less and motivated them to present their views.

Another limitation of focus groups is that it can end up as a discussion on topic completely irrelevant to the research. In order to maintain alignment with research questions researcher politely interrupted whenever the discussion drifted in other direction. Researcher maintained a list of questions as well as kept record of the time spent on each and every question using a stop watch to ensure that all questions received due time and focus.

4.7.7 Other Considerations

In addition to the aspects mentioned above there were other factors which were considered in the focus group survey:

- Data Quality: While it is extremely difficult to capture all the emotions expressed by the individuals, especially because the focus groups were only audio recorded and not video recorded, the researcher adopted the technique mentioned by Corbin and Strauss (2008). They recommended that moderators should not only capture the text of the discussion but should also transcribe other aspects of the discussion such as pause and laughter

- Reliability and Validity: There are several aspects that could affect the reliability and validity of qualitative data. In order to achieve methodological coherence researcher ensured that all the respondents had a good overview of the discussion and had ample time to prepare their responses by providing them with the sample questions at least a week in advance. Adequate explanation of key terms used in the discussion was provided and all respondents were asked if they had any questions before the beginning of the focus group discussion. Sample adequacy was achieved by ensuring that the size of the sample was between 5 (not too small) and 10 (not too big). Multiple focus groups were conducted and the discussion were conducted independent of each focus group. While excerpts are taken for the purpose of the analysis but whole of the focus groups interviews were transcripted.

- Ethical Issues: Since the research involved human participants there were some ethical considerations. This involved aspects such as full and unbiased disclosure of information (Barbour, 2007), voluntary participation and freedom to withdraw (Flick, 2007). Respondents were not provided any compensation for their participation except a light lunch that was arranged after the focus group. It was made clear to all the respondents that no other form of compensation will be provided.

  Permission of all the participants was sought before the focus group prior to the discussion. Respondents were told about all three devices being used for the audio recording of the interviews.

  At the time of contacting the respondents for inviting them to participate in the focus group detailed information sheet was provided explaining researcher's background, purpose of the research, purpose of focus group as well as explanation of how focus group data will be stored, and used. Respondents were assured that their identified will not be revealed to anyone and that no direct quotes will be provided. Respondents were told that they will be referred to by numbers rather than names.

4.8 Ethical Approval

Since this research involves human participants ethical approval was obtained from the Brunel University's Ethical Committee. The details of the data collection process were provided to the ethics committee at the time of applying for the approval.

4.9 Summary

The details of the research methodology adopted for this research is described in this chapter. The chapter began with an overview of what has been achieved in the past chapters and how does this chapter add to the sequence of steps required to achieve the objectives of this research. After this the purpose of the research was discussed. This is an explanatory research investigating the impact of different types of interactivity on effectiveness of e-learning.

This was followed by a discussion of the research philosophy. Four different kinds of philosophical standpoints were discussed along with the key differences and their applicability. This research is a pragmatists research which is based on the view that in order to develop practical solution for improving effectiveness of e-learning a context free analysis is required. Although different types of interactivity in e-learning have been widely discussed there has been no research which empirically tests the relationship of different types of interactivity with effectiveness of e-learning from constructivism perspective. Technology is dynamic and hence underling problems must be understood independent of technological barriers. Consequently pragmatic philosophical standpoint is used as it allows use of multiple methods which are useful in order to investigate the problem from diverse perspectives. Current lack of research into interactivity and effectiveness of e-learning (in terms of constructivism) requires a pluralist approach as supported by pragmatic philosophy.

Following this the choice of mixed methods strategy is discussed. Traditionally the e-learning researchers have focused mainly on quantitative methodologies due to its benefits such as generalisability, validity, reliability etc. However, critics argue that learning is contextually bound and is influenced by the learning environment and hence they support the use of qualitative research in e-learning. According to them, isolating the individuals who are the ultimate beneficiaries of the learning process is not wise. Consequently there have been calls for multi level mixed methods strategy. This research also adopts a mixed level multi methods strategy.

The data collection tools used for this research are then described. The reason for selection of questionnaire surveys and focus groups is justified and details of their application in the data collection process are provided along with their limitations and benefits. The sampling strategy adopted for both are discussed and data analysis approach used for both qualitative and quantitative data are discussed.

The next chapter presents the analysis of the data.

5. Data analysis

5.1 Quantitative data analysis

5.1.1 Data preparation- Missing values

The first analysis carried out was that of missing values. It is essential to eliminate missing values because it can distort the analysis (Hair *et al.*, 2006) although some statistical software such as SPSS use maximum likelihood method to replace the missing values. However, it was considered essential to test missing values because the responses that had more than 10 percent missing values are to be eliminated. Out of the 811 responses received 22 responses were found with more than 10 percent missing values and were eliminated leaving 789 responses for further analysis.

In addition 26 responses were found to have less than 10 percent missing responses and in these cases all the missing values were replaced by the mean of remaining responses for that particular question.

5.1.2 Data preparation- outliers

Like missing values outliers can also cause problems in analysis because it can provide misleading results. As explained in the methodology, in case of outliers, the strategy was to select the nearest value within the mean $\pm$ 2 range. This is slightly different than the strategy used commonly which includes either replacing these outlier values with Maximum Likelihood values or with Mean (Hair *et al.*, 2006). However, researcher believed that replacing it with a value which is within the permissible limits and still not too distant than the original value

reported by the respondent is the most appropriate strategy as it provides the best of both cases. On the negative side, this was quite laborious exercise. So if the mean of the responses is 2.1 then any respondent reporting outside 2.1 ± 2, that is outside 0.1-4.1 range will be considered an outlier. For example, consider someone who registered a response 5 which is an outlier as it is beyond the upper limits of 4.1. In that case the nearest number within the limit which is close to the registered response is 4 and hence respondents response of 5 will be replaced by 4.

In total 38 outliers were found. But what was interesting to note that in two of the respondents case, the number of outliers was quite high- close to 10. On close inspection it was revealed that the respondents had marked all the questions the same. It was clearly an error because the questions were randomly designed in affirmative and negative tone and this mean that the responses had different meanings. It was thus not possible to have all the answers the same. Realising this, the researcher eliminated the two responses completely leaving a total of 787 responses to work with. The number of outliers was reduced to 13 and these were replaced by the nearest within limit value as mentioned before. The final number of responses that the researcher had for the analysis was 787.

5.1.3 Data preparation- rearranging responses

For the purpose of the validity of responses, the tone of the questions was set randomly from affirmative to negative to ensure that the respondents read the question carefully before answering. However, these random answers could provide erratic results because the means and other values will be wrong. The responses for the questions which had negative tone were rearranged and recoded so that all the questions had affirmative tone and the responses were duly readjusted.

5.1.4 Sample details

Before any statistical analysis is carried out it is essential that the characteristics of the sample evaluated to ensure that the sample is not biased.

No demographic related questions were asked as these were not valuable for this research and the researcher intended to keep the questionnaire as short as possible. The first question that the respondents were asked was when was the last time they used e-learning. Criteria for participation in this research was that the respondents should have used e-learning within last two years. The distribution of the responses is shown in the figure below:

When last used e-learning

81%

14%

4%

Currently using   Last year   Within last 2 years
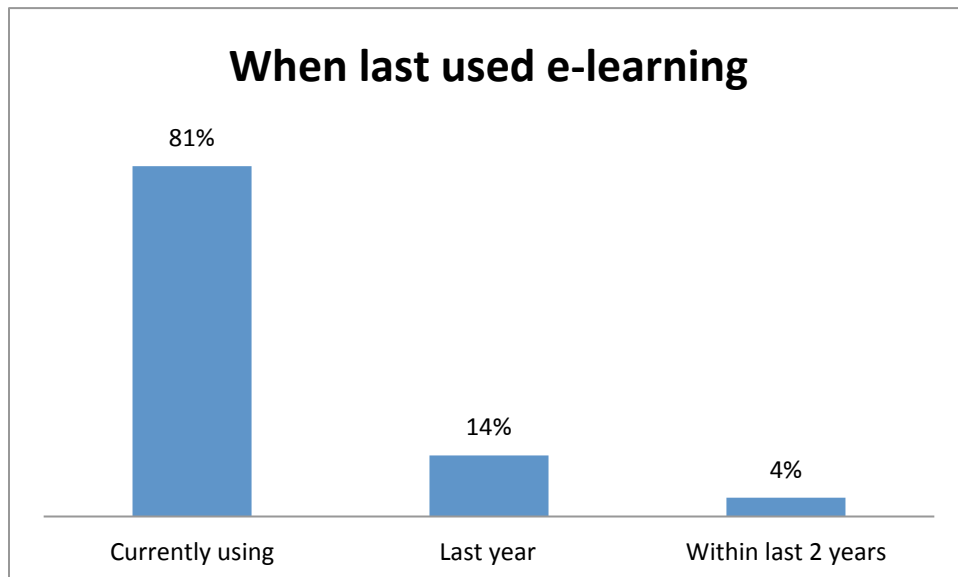
Chart indicates that most of the respondents were currently using e-learning they are current university students. Remaining 18 percent had used it within last one or two years indicating that they are most likely to have completed their university education. Ideally speaking the researcher wanted to have a higher proportion of individuals who have used it in past because these

individual can accurately reflect on the independent learning aspect i.e. they are very likely to know if they have independently used e-learning after completing formal education. Current students can only report on their intention to do so. However, despite several attempts researcher could not generate obtain more responses from these individuals.

Next the respondents were asked about the nature of their course, that is whether it is practical based or theory based. Knowing this was essential to know whether the respondents were using e-learning system for static content (that is, theory subjects) or for more practice based content.

Nature of course

48%	15%	37%
Complete theory	Complete practical	Theory and practical mix
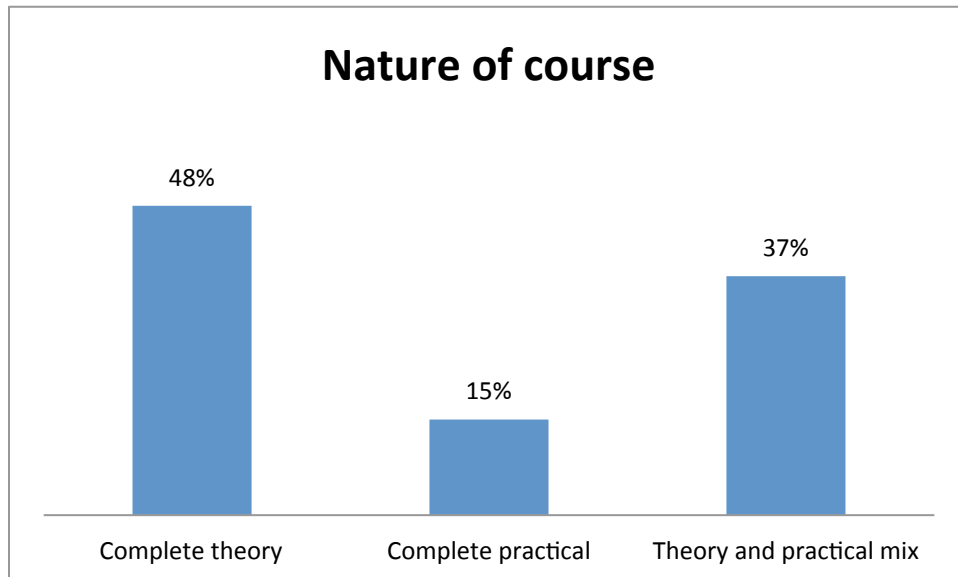
The distribution indicates that around half of the respondents were enrolled in theory based courses where most of the work was to access and understand content. However, over half of the respondents were enrolled in courses where they practically applied the knowledge gained through e-learning. This means that they were involved in active application of knowledge,

which is critical for knowledge construction. Considering the distribution the researcher is satisfied that the respondents were equally distributed in terms of their application of subjects.

Next the respondents were asked about their main stream of subject that they are studying or have studied:
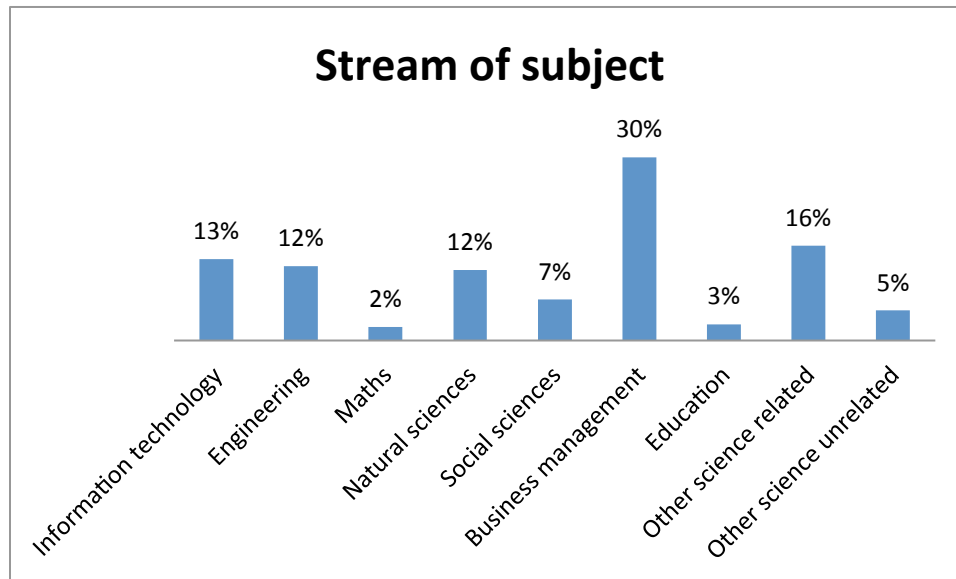
Responses indicate that most of the respondents were form business management and related fields followed by other science related fields. A large number of respondents were also from IT and Engineering background. Overall the data seems well distributed in terms of streams of subjects that the respondents are studying or have studied. It is essential to have this distribution because this research is about e-learning in general and not about use of e-learning in particular subject. E-learning may be more aligned with certain subjects such as ICT and engineering but this research is focusing on improving the e-learning effectiveness overall rather than improving effectiveness in context of a specific subject. Hence getting a well distributed sample was considered essential.

5.1.5 Model 1: Impact of different kinds of interactivities on overall course effectiveness

The first model that was tested was to investigate whether e-learning interactivity improves the learners' ability to learn the subject that he/she is being taught. Here course effectiveness refers very specifically the course/ subject being taught and course effectiveness therefore refers to how well the learner has understood the subject.

Descriptive statistics

Descriptive Statistics

	N	Mean	Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Course_Effectiveness	787	3.37	1.105	1.222	-.285	.087	-.756	.174
Int_stu_teac	787	3.21	1.062	1.128	-.451	.087	-.490	.174
Int_stu_cont	787	3.32	1.180	1.393	-.348	.087	-.768	.174
Int_stu_syst	787	3.52	1.097	1.204	-.504	.087	-.559	.174
Int_stu_stu	787	3.43	1.094	1.197	-.310	.087	-.737	.174
Valid N (listwise)	787							

Table 8 Descriptive statistics

Descriptive statistics indicate that the mean for all the variables is over three indicating an overall positive response. This suggests that respondents provided high responses for all the questions.

Furthermore, standard deviation is close to 1 for all the variables. Negative skewness refers to the length of the left tail while positive skewness refers to the length of the right tail. In other words if the data is negatively skewed it means that most of the observation are concentrated on the left hand side.
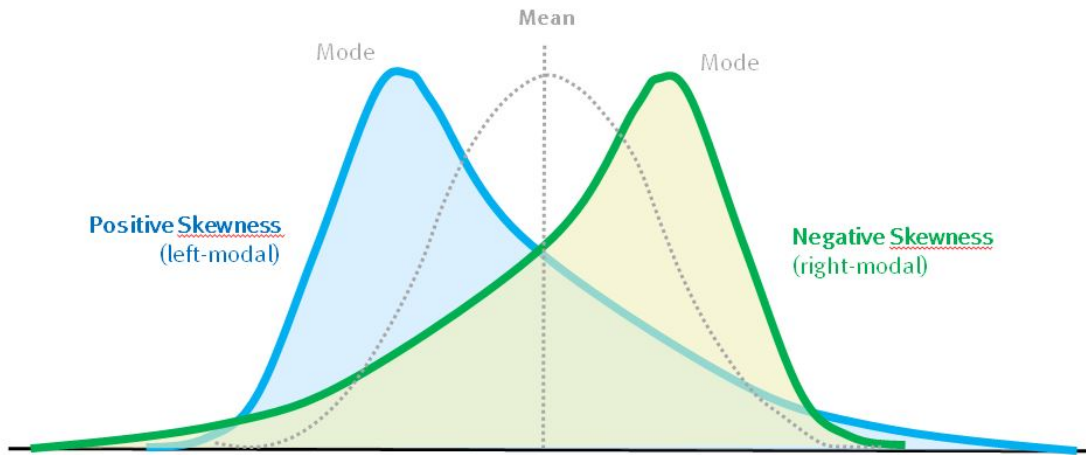
Figure 10: Negative and positive skewness sample

In the descriptive statistics we can see that all the variable distributions are negatively skewed indicating that left tail of the distributions are longer. This means that most of the values are located in the right side (which represents values more than 3), of the distribution confirming that most of the respondents indeed responded positively (response above average) to the questions.

Kurtosis refers to whether the data are peaked or flat relative to a normal distribution. Positive kurtosis refers to a peak distribution while negative kurtosis refers to flat distribution. The negative kurtosis in the descriptive for all the constructs indicate that for all the variables the distribution of the responses was flat.

T-test for means

To test whether the means were truly above average value of 3, t-test for testing of means was carried out. The *t* test indicates sample differences by using means and the distribution of sample scores around the mean. If two samples differ from each other in any significant way, then the test statistic will result in the decision to reject the null hypothesis.

There are two types of t test. A matched samples *t* test which is used when working with related samples or repeated measures (a more powerful form of the Wilcoxon test). The independent samples *t* test is used for independent samples (a more powerful form of the Mann-Whitney U test). The assumptions of the independent samples t-test are normally distributed dependent variables, homogeneity of variance, and independence of groups. The homogeneity of variance assumption was tested for the t-test.

The test value was 3 and the output of the t-test is given below:

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Course_Effectiveness	787	3.52	1.105	.039
Int_stu_teac	787	3.55	1.062	.038
Int_stu_cont	787	3.43	1.180	.042
Int_stu_syst	787	3.52	1.097	.039
Int_stu_stu	787	3.43	1.094	.039

One-Sample Test

	Test Value = 3					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Course_Effectiveness	13.156	786	.000	.518	.44	.60
Int_stu_teac	14.600	786	.000	.553	.48	.63
Int_stu_cont	10.238	786	.000	.431	.35	.51
Int_stu_syst	13.221	786	.000	.517	.44	.59
Int_stu_stu	10.949	786	.000	.427	.35	.50

Table 9 One sample t-test results

For all the variables the sig.(2 tailed) is .000 i.e. less than 0.001. This confirms that for all the variables the mean value is different than the test value 3 and the test also indicates that actual values are more than 3. This confirms the findings of descriptive statistics that the mean value of all the variables is positive.

It is important to tests the mean using T-test because the mean value observed in descriptive statistics could be because of outliers. Outliers represent the extreme responses which can significantly affect the model. Although tests was conducted to eliminate the outliers but there still a possibility of certain individuals registering extreme responses close with the upper / lower limits of the outlier test.

T-test provides reliable estimates of mean value and the mean value being higher in t-test indicates that the average value for all the four variables was indeed above 3 and it was not because by chance (i.e. because of outliers).

Correlation test

Correlation is a measure of co movement of variables. Correlation tests are used to assess whether there is a relationship between two or more continuous (interval or ratio) variables. It is important when reporting correlations to be clear that a significant correlation does not necessarily mean cause and effect. It merely means that the two variables are likely to move in the same direction but not that increase in one variable will cause rise in the other variable. The two variables move independent of each other.

However, it is useful to test for correlation before testing causal relationship (through regression) as it provides an insight into the movement pattern of the two variables. Output of correlation test is given below:

Correlations

		Effectiveness	Int_stu_teac	Int_stu_cont	Int_stu_syst	Int_stu_stu
Course_Effect iveness	Pearson Correlation	1	.734**	.653**	.805**	.878**
	Sig. (2-tailed)		.043	.031	.017	.000
	N	787	787	787	787	787
Int_stu_teac	Pearson Correlation	.734**	1	.860**	.842**	.836**
	Sig. (2-tailed)	.043		.000	.000	.000
	N	787	787	787	787	787
Int_stu_cont	Pearson Correlation	.653**	.860**	1	.813**	.826**
	Sig. (2-tailed)	.031	.000		.000	.000
	N	787	787	787	787	787
Int_stu_syst	Pearson Correlation	.805**	.842**	.813**	1	.881**
	Sig. (2-tailed)	.017	.000	.000		.000
	N	787	787	787	787	787
Int_stu_stu	Pearson Correlation	.878**	.836**	.826**	.881**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	787	787	787	787	787

**. Correlation is significant at the 0.01 level (2-tailed).

Table 10: Correlation test results

As per the results of correlation tests, Course effectiveness is statistically significantly correlated with all the four types of interactivity at 95% confidence level. Furthermore, the positive

correlation coefficients indicate that the correlation between course effectiveness and four types of interactivity is positive. Correlation however, merely tells us that that the variables are moving in the same direction but tell us nothing about whether there is any causal relationship between the variables- i.e. they are moving in the same direction but is one of the variables causing other variable to move.

This problem can be resolved through regression which helps us establish causal relationship.

Regression Test

The first regression model tested the following four hypothesis:

Hypothesis H_1:   Student content interaction allows students to learn their subjects better.

Hypothesis H_2:   Student-teacher interaction allows students to learn their subjects better.

Hypothesis H_3:   Student-student interaction allows students to learn their subjects better.

Hypothesis H_4:   Student-system interaction allows students to learn their subjects better.

Researcher conceived the following model to test for the relationship between *course effectiveness* and the four kinds of interactivity, that is, to determine whether the four kinds of interactivity have a statistically significant impact on *course effectiveness*.

Course_effectiveness $= \alpha_0 + \alpha_1 *$ Int_stu_stu $+ \alpha_2 *$ Int_stu_cont $+ \alpha_3 *$ Int_stu_teac $+ \alpha_4 *$ Int_stu_syst

Where α_0, α_1, α_2, α_3, α_4 are coefficients of regression.

The present study has used the 5% level of significance to reject the null hypotheses formulated at the start of the study. If the probability of the event occurring by chance alone is less than 5% then the null hypothesis can be rejected. Thus the minimum level of significance is set at *P=0.05*.

The true population value for the variable of interest is not known and therefore an estimate from the sample (the mean) is the best guess (Bowling 2002). To tell how good that estimate is a confidence interval (CI) is formed. The level of confidence can be set to any figure but for most studies it has been set at 95%, that is to be willing to be incorrect 0.05 of the time (one in 20 times). A 95% CI for the population mean is an interval which, if calculated for each of many repeated samples of the same size and from the same population, would, for 19 out of 20 samples, be found to contain the true population mean (Bowling 2002).

There are mainly five values in regression output that are of interest

Prob value: is the p-value of the model. It indicates the reliability of independent variable to predict the dependent variable. Usually we need a p-value lower than 0.05 to show a statistically significant relationship between the independent variable and the dependent variable.

R-square: shows the amount of variance of dependent variable explained by independent variable.

Adj R^2: shows the same as R^2 but adjusted by the number of cases and number of variables. When the number of variables is small and the number of cases is very large then Adj R^2 is closer to R^2. This provides a more honest association between dependent variable and independent variable.

The t-values: test the hypothesis that the coefficient is different from 0. This hypothesis is rejected, at 95 percent confidence level, if the t-statistic is more than 1.96.

Two-tail p-values: test the hypothesis that each coefficient is different from 0. To reject this, the p-value has to be lower than 0.05 (for 95% confidence level).

The table below gives the output of the regression test

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Int_stu_stu, Int_stu_cont, Int_stu_teac, Int_stu_syst[b]	.	Enter

a. Dependent Variable: Course_Effectiveness

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.692[a]	.478	.441	.454

a. Predictors: (Constant), Int_stu_stu, Int_stu_cont, Int_stu_teac,

Int_stu_syst

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.209	.058		3.602	.000
	Int_stu_teac	.409	.035	.105	11.685	.022
	Int_stu_cont	.286	.029	.305	9.733	.013
	Int_stu_syst	.155	.034	.154	4.502	.021
	Int_stu_stu	.311	.035	.403	8.853	.000

a. Dependent Variable: Course_Effectiveness

Table 11: Regression model 1 output

The value of Adj-R^2 is close to R^2 indicating that the sample has sufficient number of cases. However, this value can be further improved by increasing the number of cases.

Adjusted R-squared value of 0.441 indicates that the four interactivity dimensions included in the model can explain up to 44.1 percent variation in the values of course effectiveness. This is understandable because apart from interactivity there could be several other variables that could affect course effectiveness such as awareness, knowledge of using computers, access to computers and internet etc. However, the model does confirm the impact of interactivity on course effectiveness. While considering course effectiveness here it must be understood that course effectiveness here is referring to perceived course effectiveness and not true course effectiveness. Similarly, the four dimensions of interactivity are also perceived values of interactivity.

All coefficients of regression are positive indicating that all aspects of interactivity have a positive impact on course effectiveness. Furthermore, the p-value (sig.) for all the four independent variables are less than 0.05 confirming that the relationship is statistically significant at 95% confidence level. This means that all four types of interactivity do have a positive and statistically significant causal relationship with course effectiveness. In other words, the model indicates that it is possible to improve course effectiveness by improving the four dimensions of interactivity.

Model also indicates that Student-teacher interactivity may have the most significant impact on accessibility out of all the four types of interactivity followed by student-student. Student-Student interactivity is what is missing from most e-learning solutions especially those which are static. E-learning solutions which are delivered in one way communication process often eliminates the possibility of student-student interaction and the findings of this research indicates that it affects their perceived course effectiveness of e-learning.

5.1.6 Model 2: Knowledge construction skills and interactivity

While course outcomes refer to how the students perceived that e-learning improved the knowledge about the subject they were studying but knowledge construction skills refer to effectiveness in terms of becoming independent learners i.e. whether the students believe they can learn new things using e-learning without the need of entering a formal education system. This variable is hereby referred to as *independent learning* skills.

Correlation statistics

The table below shows correlation test results.

Correlations

		constructivist_skills	Int_stu_teac	Int_stu_cont	Int_stu_syst	Int_stu_stu
	Pearson Correlation	1	0.502**	.619**	0.327	.419**
	Sig. (2-tailed)		0.014	0.038	0.071	0.003
Utilisation	N	787	787	787	787	787

**. Correlation is significant at the 0.05 level (2-tailed).

Table 12: Correlation test output

Correlation test indicates that there is improvement in knowledge construction skills/ independent learning is positively and statistically significantly correlated with Student teacher, Student-content and Student-Student interactivity. Student-system interaction was not found to be significantly correlated with e-learner's enhancement in independent knowledge construction skills.

Regression Test

The second regression model tested the following hypothesis:

Hypothesis H_5:   Student content interaction in e-learning develops students' independent learning skills.

Hypothesis H_6:   Student-teacher interaction in e-learning develops students' independent learning skills.

Hypothesis H_7:   Student-student interaction in e-learning develops students' independent learning skills.

Hypothesis H_8:   Student-system interaction in e-learning develops students' independent learning skills.

The model tested for regression was

Knowledge_Construction_skills = $\alpha_5 + \alpha_6$* Int_stu_stu + α_7* Int_stu_cont + α_8* Int_stu_teac + α_9* Int_stu_syst

Where $\alpha_5, \alpha_6, \alpha_7, \alpha_8, \alpha_9$ are coefficients of regression.

The table below gives the output of the regression test

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Int_stu_stu, Int_stu_cont, Int_stu_teac, Int_stu_syst[b]	.	Enter

a. Dependent Variable: constructivist_skills

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.617[a]	.381	.272	.298

a. Predictors: (Constant), Int_stu_stu, Int_stu_cont, Int_stu_teac, Int_stu_syst

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
	Int_stu_teac	1.158	0.202	0.191	5.734	0.013
	Int_stu_cont	0.627	0.293	0.241	2.142	0.047
	Int_stu_syst	0.629	0.516	0.097	1.219	0.179
1	Int_stu_stu	0.448	0.107	0.257	4.186	0.031

a. Dependent Variable: constructivist_skills

Table 13: regression model 2 output

Adj R-squared value of 0.272 means the four kinds of interactivity can explain 27.2 percent of variance in development of independent e-learning knowledge construction skills. This is quite low indicating that there are several other factors (not included in the model above) which could have an impact on the development of independent learning skills among Saudi students.

All coefficients are positive indicating that all four kinds of interactivity have a positive impact on independent learning skills of the students. However, as expected after the correlation test, student-system interactivity has no statistically significant impact on independent learning skills of the students but other three forms of interactivity (student-teacher; student-content; student-student) do have a statistically significant and positive impact on independent learning skills of the Saudi higher education students.

The highest coefficient of regression is for student-teacher interactivity which indicates that student-teacher interactivity has the maximum influence on learners' independent learning skills.

5.1.7 Model 3:   Independent learning intentions and interactivity

Independent learning intentions refer to the intentions of learner to continue learning independently after finishing formal education.

Correlation test

Correlations

		Int_stu_teac	Int_stu_cont	Int_stu_syst	Int_stu_stu
Learning_behaviour	Pearson Correlation	0.415	0.317**	0.276	0.668**
	Sig. (2-tailed)	0.058	0.033	0.087	0.001
	N	787	787	787	787

**. Correlation is significant at the 0.05 level (2-tailed).

Table 14: Correlation test results

Correlation test indicates that all four types of interactivity are positively correlated with both learning behaviour. However not all kinds of interactivity have statistically significant correlation with behavioural outcomes. Only student-student and student-content interactivities were found to be statistically significantly correlated with learning behaviour.

Regression Test

The third regression model tested the following hypothesis:

Hypothesis H_9:   Student content interaction motivates students to learn independently without formal instruction.

Hypothesis H_{10}:   Student-teacher interaction motivates students to learn independently without formal instruction.

Hypothesis H_{11}:   Student-student interaction motivates students to learn independently without formal instruction.

Hypothesis H_{12}:   Student-system interaction motivates students to learn independently without formal instruction.

The model tested for regression was

Learning_behaviour $= \alpha_1 + \alpha_2*$ Int_stu_stu $+ \alpha_3*$ Int_stu_cont $+ \alpha_4*$ Int_stu_teac $+ \alpha_5*$ Int_stu_syst

Where $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5$ are coefficients of regression.

The table below summarises the output of the regression tests

	Model 4
Dependent variable	Learning_behaviour

Adj R-squared	0.197
Coefficient (Student-student)	8.479 (p value = 0.000)
Coefficient (Student-content)	4.138 (p value = 0.003)
Coefficient (Student-teacher)	0.387 (p value = 0.103)
Coefficient (Student-system)	2.003 (p value = 0.096)

Table 15: Summary of regression model 3 output

In case of learning behaviour only student-student and student-content interactivities are found to have any statistical impact on behavioural outcomes while student-teacher and student-system interactivities have no statistical impact on learning behaviour.

Thus, based on the three regression models the following outcomes were obtained for the tested hypotheses:

Hypothesis	Regression model	Outcome

Hypothesis H$_1$: Student content interaction allows students to learn their subjects better.	Model 1	Accepted
Hypothesis H$_2$: Student-teacher interaction allows students to learn their subjects better.	Model 1	Accepted
Hypothesis H$_3$: Student-student interaction allows students to learn their subjects better.	Model 1	Accepted
Hypothesis H$_4$: Student-system interaction allows students to learn their subjects better.	Model 1	Accepted
Hypothesis H$_5$: Student content interaction in e-learning develops students' independent learning skills.	Model 2	Accepted
Hypothesis H$_6$: Student-teacher interaction in e-learning develops students' independent learning skills.	Model 2	Accepted
Hypothesis H$_7$: Student-student interaction in e-learning develops students' independent learning skills.	Model 2	Accepted
Hypothesis H$_8$: Student-system interaction in e-learning develops students' independent learning skills.	Model 2	Rejected
Hypothesis H$_9$: Student content interaction motivates students to learn independently without formal instruction.	Model 3	Accepted
Hypothesis H$_{10}$: Student-teacher interaction motivates students to learn independently without formal instruction.	Model 3	Rejected
Hypothesis H$_{11}$: Student-student interaction motivates students to learn independently without formal instruction.	Model 3	Accepted
Hypothesis H$_{12}$: Student-system interaction motivates students to learn independently without formal instruction.	Model 3	Accepted

Table 16: Summary of hypothesis test results

5.2 Qualitative data analysis

The primary themes that were discussed in the focus groups were as follows:

- Student-teacher interactivity
- Student-content interactivity
- Student-system interactivity
- Student-Student interactivity
- Course effectiveness
- Independent learning skills
- Independent learning intentions

These are discussed in separate sections below

5.2.1 General discussion

Respondents indicated that most of the online courses are in technology related streams such as science, engineering, IT etc. Non technical courses such as History, Arts etc. are generally taught through conventional model. According to one of the respondents, this could be because *the students taking technical courses are considered to be tech savvy making it easier for them to make use of online channel of teaching*. On the other hand, students studying non technical courses are students who are more interested in non technical aspects. However, it was also argued that *it is wrong to assume that students who are studying non technical courses are not tech savvy*. Furthermore, *it is also wrong to assume that only tech savvy students can make use of the online courses. Technology aspects of E-learning are handled at the back end meaning the user just need to know how to use the interface. So the significance of the technical skills of the*

individuals is minimised. However, poorly designed e-learning systems would require individuals to have the technical skills for the making use of e-learning system. Non technical subjects are mainly static content driven as they contain very little practical content. This makes it easier to deliver this content online and hence it would be even easier to teach these subjects online. However, the focus is more on technical subjects to be provided online which indicates that there is strong inclination towards ability of learners than on content and teachers.

In terms of student to teacher ratio, most respondents indicated a teacher to student ratio of around 50 which is quite high as compared to classroom environment where it is expected to be between 15 and 25. This indicates that most e-learning providers consider e-learning as a tool to increase economies of scale at the expense of quality of education. This was also clarified by the responses. For example, one of the respondents commented *"it depends on course to course. There are courses where it is around 15 to 1 but there are also courses where it reaches 100 to 1.* The benefit of e learning is that education service providers can accommodate large batches but in certain courses it is not possible due to intensity of course.

Many respondents complained of extremely high rates of subscription of online courses making it difficult to achieve individualised consideration that can be achieved in classrooms.

This highlights a significant flaw in the e-learning system- higher student to teacher ratio means that there is less attention on quality and more on quantity. This leads to poor delivery. E-learning is supposed to make learning convenient for the learners but the focus is on delivery aspect as most institutions tend to look for convenience in providing the education. This provider focused system ignores the effectiveness aspect. One of the respondents shed some light on this: *"it is true that to a large extent the current e-learning system is focused on providing information more efficiently but it does not focus so much on the learning aspects. It is rather a one way system in which the university provide as much information as they can as cheaply as possible to the students but I know that it is difficult for the students to absorb all this information."* His views confirmed that the focus is more on reducing the cost and increasing the coverage but as

argued in this research, this strategy is leading to lack of focus on effectiveness (in terms of learning itself). In other words, it is quality Vs quantity trade off. This poor quality of education in e-learning is also perceived by the students due to which most students show preference for classroom teaching despite the obvious time, location and cost benefits of e-learning.

Thus the respondents were clear that the level of interaction required limits the student to teacher ratio in technical subjects. None of the respondents talked about how it affects the quality of education because high level of interactivity is required in certain arts and crafts subjects as well. One of the respondents commented that this ratio is governed by the student teacher ratio in classroom environment. According to him "*the student teacher ratio is low in technical subjects in classroom environment also but in non technical subjects such as history this ratio is high anyway. So the same model is reflected in the online environment.*"

Overall speaking there is a subject related bias in e-learning design with technical subjects receiving greater attention and hence higher degree of interactivity as compared to non technical subjects.

Talking about the main decision factors in determining the right student teacher ratio, one of the respondent commented "*the most significant factor should be the interaction required between the teacher and students. If the content is to be delivered passively – just like posting notes and materials to read then they can afford to have more students per teacher. When the level of interaction required is high then they should maintain a low teacher to student ratio to ensure that the teacher can pay sufficient attention to all the students.*"

Another interesting thing in respect to e-learning systems was that the ratio of students to teacher was high in subjects such as history and arts while these were lower in subjects such as science and technology. Clarifying this one the respondents suggested: "it could be because *science and*

technology is more interactive subjects and require close interaction between the teacher and students. If you look at history and arts, most of the content is static and less interactive so teachers can provide content to the students and interact on ad hoc basis. This strategy will not work with science and technology because there the teacher must engage closely and continuously with the students irrespective of the topic. Because of the level of interaction required in technical subjects the student to teacher ratio is kept low in these subjects." Another respondent commented "*ideally speaking it is better to have a same student to teacher ratio as in classes because the main purpose of e-learning is to make it easy for students to learn from wherever they want and not for universities to cut costs.*" Another respondent commented that: "*This is more to do with how closely the teacher has to engage with the students. Subjects with more practical aspects are mainly taught with interactive systems in which the teachers and students engage in idea sharing. While, the subjects which are mainly theoretical and text based does not require too much support from the tutor and can be taught through online systems and it is fine to have high student to teacher ratio.*" This is interesting because this shows that some learners are okay with high student-teacher ratio in certain courses such as those courses which require little interaction between teacher and student.

Respondents were quite clear that high student-teacher ratio has a significant impact on their learning. As one of the respondents commented: "of course it is a problem. Just imagine if the teacher has 50 students to pay attention to. Can he solve all their questions? After all he is also a human being and he only have 24 hours in a day. It does not matter if it is online or in class. Teacher should not be pressured into supporting a lot of students." Another respondent supported his view and commented that "I had a terrible experience with my tutor. He had no time for the students so he kept on telling us to discuss among ourselves and go to him only if absolutely necessary. After him not responding to my emails he told me that he gets so many emails from students that it is not possible for him to read and respond to all the emails. But as a student I expected him to reply so I would say that they should focus on keeping this number down to make sure that the teacher can pay attention to all the students."

5.2.2 Student-teacher interactivity

Respondents were quite clear that student-teacher interactivity is quite important in e-learning. According to the respondents F23 "*teachers are key to learning- it does not matter classroom or online. If the teachers teach us well then everything is easy but if the teacher is not good then it is as good as having no teacher.*" Respondents F36 commented "*teachers will remain important no matter what. Students learn from the teacher so it is absolutely critical to have strong relationship between the teacher and the student*". One of the respondents who had a teaching background articulated this as follows: "*teachers are the key. Without teachers the content is nothing but just some words and images. Teachers help the students in making sense of it. But if the teacher does not interact with the student he will not be able to convey the true meaning behind those words and images. So I think it is absolutely essential for the teacher to interact with the students in e-learning.*" One of the respondents went as far to suggest that "*I think the need for teacher and student interaction is more in e-learning than in classroom. In classroom, teacher can interact through other means such as his presence itself is an interaction. But in e-learning he has to make extra effort to reach out to the students – if he does not make this effort then for the students he pretty much does not exist.*" Respondents were quite clear that teacher-student interaction is critical in context f e-learning and that this interaction does have an impact on the learning of the individuals.

Student-teacher interaction and course outcomes: Respondents were asked how their interaction with the teacher affected their learning about the subject that they were studying. Respondents provided similar views in this case. Respondent F12 commented "*I was studying business management and had two modules on finance and accounting. I had no prior knowledge of finance. I had a look at the financial statements and it was all a mumbo jumbo for me. So for me whatever I learnt was through the teacher. He explained in detail what the figures in these statements mean and how these could be interpreted. I had the text book but there is no way I could have learnt that without the teacher.*" Another respondent provided similar

reflection: "*I am sure that most of the content that I learnt during my course was through the teacher. It is quite obvious also because if the teacher is not required then what is the need of the university. I can simply go online download the content and I am fine then. But it is not as simple as that. Teachers are really important.*" Respondent F44 commented: "teachers play an important role in learning about the subject. Teachers are the experts and the only reason why people go to universities is the teachers. So if the teachers interact properly with the students and teach them whatever they know the students will also learn about the subject. But if the teacher does not interact or does not teach the students everything then the students will not learn. So there is a very simple answer to your question- teachers' interaction with student is very important for the students to learn about the subject."

Almost all the respondents were unanimous in supporting teacher-student interaction's role in course related outcomes. Students gain from the expert guidance and support of the teacher and the teachers help them understand the course content. The role of the teacher is thus to facilitate learning. One of the respondents who was a teacher provided a different take on the whole process of teacher-student interaction. He commented "*according to me teacher student interaction develops in phases. When the student enters the course he knows little about the subject so the focus is solely on how effectively the teacher can help them develop the understanding the basics of the subject. However, after some time when the student has learnt the basics of the subject an when application is required then the teacher should simply support the student and not assist him to the same degree because by this time the student should be able to use the knowledge himself.*" Another respondent in the same focus group supported his views and commented "*I agree that the role of the teacher cannot be constant. Teacher should interact as much as possible at the beginning. This will not only help the students learn the basics but they will also be more confident that they have the desired support. But as the time progresses, teacher should reduce his interaction with the students so students can start learning to implement the knowledge.*"

One of the respondents (F52) disagreed that teacher-student interaction is critical. According to her: "*teacher is important but is higher education the students should be intelligent enough to learn by themselves. In my opinion teachers should be there to support the students when they need but hey should not spoon feed the students. As adult students this is not good thing.*" This was quickly refuted by another respondent who argued: "*the problem is that university education is completely different from secondary education. What you are saying is that people who have completed secondary should be able to study university courses without help. It is not possible unless you are a genius. University courses are so professional and so high level – I don't think it is possible for anyone to complete it without proper teaching.*"

Student-teacher interaction and independent learning outcomes: Respondents were asked how their interaction with the teacher helped them develop the skills for becoming independent learners. The respondent (F52) who argued against too much student-teacher interaction argued: "*this is exactly what I was saying. If you have too much interaction then you become dependent on the teacher and then you do not learn the skills to study independently. I stand by my argument that teacher student interaction should be kept to only the required levels. So teachers should only interact when students ask for help.*" Another respondent argued "*teachers should have s strategy to develop these skills. I mean teacher student interaction is important for the teacher to be able to teach these skills to the students.*"

Several other respondents supported the view that teacher student interaction is also critical for students to be able to develop independent learning skills. One of the respondents commented: "*students need to become independent learners but this does not mean that teacher's role is finished. In fact it is the teachers who must teach the student how to become independent learners.*" Another respondent commented: "teachers are themselves independent learners so who is better than the teachers to teach the students how to become independent learners." One of the respondents provided more clarification based on his own experience form the past. According to him: "*teachers need to have a strategy regarding how they will develop these skills. There is a lot of science involved about how individuals learn and how teachers should teach. It*

is how the teachers undertake the teaching process. What I think is that teachers must interact in a two way communication process making students participate in the learning process. If the students are active in learning they will eventually deveop independent learning but if the teachers spoon feed the students then they wont."

Another respondent commented: "*I think these are two different things we should understand the role of the teacher. Teacher teaches the skills. If the teacher is not going to teach the student how to learn independently how will they learn. It is like swimming. I swim independently but that does not mean I was thrown in open waters to learn by myself. Someone taught me and gradually I became independent.*" One more respondent commented: "teachers are critical for learning mo matter what you want to learn whether it is subject or skills. Teachers need to teach for the students to learn."

One of the respondents provided an interesting observation. According to him: "the biggest problem is that the teachers who are teaching e-courses themselves do not have the e-learning skills. They are basically subject experts so they teach the subject. They have not used e-learning themselves so they use e-learning as an aid to teaching rather than teaching the students about e-learning itself." When asked about the possible solutions, the respondent commented that "I think all the teachers should be trained in use of e-learning materials. The problem is that teachers themselves do not know enough of e-learning and hence they do not teach it or shall I say cannot teach." Other respondents agreed with this view. For example one of them commented: "most of the teachers in online courses are those who have been teaching in universities for years. For them e-learning is a new thing and they have little experience of using e-learning as a student. If they cannot think from student's perspective how do you expect them to teach fro hat perspective. If they interact more with the students they will learn about student's perspective such as the issues that the students are facing." Another respondent quoted one incident: "once I was told by my teacher to download some papers from IEEE website and write an essay based on that. It took me two weeks to figure out how I can download the papers because the teacher didn't teach us. He did not even give us the institutional login details till

someone asked him specifically and then he asked the IT people who then provided it to the students. Teachers must know about e-learning so I think this should be made a compulsory training course for every teacher to attend." The respondent who had taught in past agreed and commented "*most of the teachers especially senior professors in the universities have limited experience of using e-learning. They have used static technology such as powerpoint presentations but they are not really tech savvy. How old do you think is e-learning in the Kingdom. Barely 6-7 years and we are yet to produce stream of professors who are adapt at e-learning.*" One of the students who have studied in Saudi university as well as in a British university argued: "I have studied in both Saudi and British universities. When I went there I had absolutely no idea of how to use the Moodle- the blackboard even though I have had three modules of e-learning in my Bachelor's degree. The problem is that even though we had e-learning modules the teachers were still giving us handouts and telling us to go online if we need more information. They never actually motivated us or supported us in going online and searching for information."

Thus, most of the respondents agreed that student teacher interaction is critical in developing independent e-learning skills but the respondents also agreed that poor e-learning skills of the teacher and poor interaction with students is hampering the efforts in improving e-learning sills of the students.

5.2.3   Student-content interactivity

Next the respondents were asked about student-content interactivity. Respondent F22 commented "how the course is organised is quite important. I think it allows student to learn so courses should be designed and content should be provided which helps in learning." Another respondent commented "I agree. How the content is presented and how the course is organised is quite critical. I told you –my teacher used to give us the handouts and we never found the need to go online even though the course was supposed to be taught as an online course." Other

respondents also agreed that interactive content is quite critical for e-learning. Respondent F34 commented "student content interactivity is quite essential because in e-learning content has to speak for itself. If the students find it difficult in accessing the content then the whole point of e-learning will be missed." Indeed e-learning is quite different as compared to classroom model. In Classroom model students have to simply find the books and other printed material to read. It is quite straightforward but in e-learning there is vast amount of information and accessing it is quite a challenge. One of the respondents reflected on her experience: "when I went to UK to study I was impressed by my teacher who taught us in a step by step manner how to access content online. I mean where to go which kind of sources to read, how to select the key words, how to organise the content that you have accessed. In fact he took two weeks teaching us just these. I could not understand the purpose of that at that time. But as I started my course I realised how much of a help that two week effort was. I was very confident findings the sources, making notes based on the sources and critically analysing the sources. It was amazing experience and I must say I have developed significantly as a result. All in all I believe the manner in which the teacher structured the course was quite critical." Similarly other respondent commented "*often there is a hurry to teach the subject but if someone does not know how to read what use will it be to give him the book. I mean if the student don't know the basics of the system then what use will it be to start teaching him e-learning. I have seen in Saudi universities they simply think that downloading a paper form online is e-learning. That is not true. But the problem is that, thats what they have learnt and that is what they are teaching.*"

Other respondents also commented that adequate organising of the course so that the student can learn gradually is better approach. Respondents agreed that students should be able to interact with the content and they should be taught the skills to interact with the content.

Student-content interaction and course outcomes: According to the respondents student's ability to interact with the content plays a significant role in course outcomes. However, some of the respondents provided an alternative opinion. According to one of them: "technically and logically speaking it should but it does not. The problem is again with the teachers. Teachers,

even the e-learning teachers teach the course in a very structured manner which means that students do not need to worry about interactive content." Other student agreed and commented that even the e-learning courses are very structured meaning the students need not worry about interacting with the content. Another respondent commented: "interactive content is not used in e-learning courses but I think if they do it it will be useful. The problem is the manner in which the e-learning courses are designed in Saudi universities. Firstly, the teachers lack the skills so they structure the courses as if it was classroom. You would often see the teacher sending you 2-3 articles to read. Now this is not e-learning."

Respondents however agreed that logically speaking having an interactive content should help in achieving subject outcomes because the students will get used to the system and will be able to use the system as per his/her convenience without relying on others. Content interactivity means how easy is it to use the course overall which means how the course is organised and how the course content has been organised.

One of the respondents commented "the problem is that the e-learning courses have been designed to look just like classroom courses. Now classrooms are not interactive- we go there, teacher teaches us and we learn what we have been taught. We do not explore alternatives." The respondent had a strong point in that e-learning is about being able to challenge and critically evaluate. If the courses are designed so as to critically evaluate then the students are able to develop better subject knowledge as they are able to gain knowledge of different perspectives in their field of knowledge. Having structured models of e-learning are counterproductive in that students miss out on most of the useful aspects of e-learning. One of the respondents shed some light in this respect: "*if you go abroad you will see that the teachers organise the content so that students are asked to look for evidence and counterevidence. The more critical your evaluation the higher the score and hence students learn to challenge. But in Saudi universities you will see very strict boundaries being set- the teachers themselves do not like to be challenged. The questions they ask are not open ended but very directed which means that is only one answer. Unless they start asking the students to explore and bring evidence from different sources they*

will not learn." Another respondent commented, "*my teacher never asked me to read beyond what is provided. He provided some articles online which only presented one line of through-probably the one he followed. He never told us to read anything beyond that. Thus I don't think I have the depth of knowledge that I could have achieved if my teacher organised the course so that the students are encouraged to dig deeper.*" Another student complained about the system and commented "*this exam thing is wrong. I think what we should have is coursework like they have in foreign universities and all students should be given different topics of their coursework. What about we let the students choose titles for their coursework and then discuss each and every. This will help the students learn more about their subject.*"

Other students also commented that they were not satisfied by the manner in which e-learning courses are organised. The most significant concern was that students were not taught the skills of e-learning and that during the course they were not asked to read extensively meaning that they had very limited knowledge of the subject. The respondents agreed that getting good grades is not an issue because the teachers ted to ask the questions from within what they have taught but as one of the respondents commented "I know that despite my goo score I have little knowledge of my subject. I was not taught the subject the way I expected or the way it is taught in western universities. They could have used more case studies rather than theoretical models. Now I know a lot of theories but cannot apply it." Some other students also argued that it has proved very problematic for the as they do not have the kind of skills and that is one of the reason why they never liked e-courses.

Student-content interaction and independent learning outcomes: According to the respondents the student-content interaction can play a significant role in developing independent learning skills. A one of the respondents commented "indeed the students learn from the manner in which the course is structured. So if it is structured as to develop independent e learning then the students will develop independent learning and if it is not then they will not." Another respondent commented "*a great deal of independent learning skills development depends on how e-learning courses are designed. Students should be taught the skills for e-learning before they*

are taught the subjects. Once they have the skills the teacher just need to motivate them to read more and guide them. But the problem is that most of the e-learning courses are so structured and defined that students do not need to explore any further." Another respondent disagreed and commented "I think that my e-learning course has taught me a lot in terms of how to look for information and verify it and how to analyse it. I have learn this over three years and now I am very confident that I will be able to learn about anything that I want. I agree that this is largely because of the manner in which I taught. The exercises and the whole course was taught in a very smart manner." Another respondent agreed and commented that "e-learning course design is very important in developing independent learning skills because it is the experience of learning through these courses which help the students in developing these skills. I am not sure what is the best form of interactive content but I think using a lot of visuals, organising the course so that students get enough chance to explore on their own could be useful approaches" Other respondents also agreed with this view. Respondent F35 commented "if you look at the whole e-learning exercise you would see that the organisation of the course is quite critical. Teachers who design the courses so that students learn on their own are more effective and the students also learn more. But if you do not allow the students to explore and limit them to what is being taught in the class then it is not a useful approach. Students will then not learn to learn independently

Another respondent argued that: "I think teachers should not ask the students to explore more about their subjects only but about some random new topics so that they get a feel of what e-learning is about. They can also have a separate course about e-learning skills itself. It could be made compulsory for all."

Overall speaking the respondents agreed that student-content learning can play a vital role in both subject learning and development of independent learning skills. However the respondents suggested that current e-learning content is somewhat limited in this respect as most courses are designed in a very structured manner which does not allow independent thinking. It should be noted that the respondents were commenting on their experiences in Saudi higher education institutions. Some respondents however acknowledged that e-learning systems in some western

nations are very useful in that respect. Respondents provided some useful recommendations and the most interesting one was that all students can be asked to do a compulsory e-learning module which can be about e-learning skills and among the requirements could be to do an independent project using e-learning skills. However, this would still not cover for the content interactivity and e-learning program designers have to consider developing more interactive course designs.

5.2.4 Student-system interactivity

Next the students were asked about student-system interactivity. System here refers to the technological system that is used to access e-learning content. This includes both hardware and software. Students agreed that system is an important component of the e-learning system but their view about the role played by the system in the overall e-learning system were quite varied. For example, one of the respondents commented "I don't think the system is that important. Look, I think the same system is being used the world over. And I don't think the difference we have in our learning with that in top universities is due to the system. It is because of other factors. Similar views were presented by another respondent who argued "I think the system is a requirement but I don't think it plays much of role. I mean you cannot have a bad system but once you have an interactive system in place, you do not need to do much about it." However, another respondent disagreed "*I think having an interactive system is critical. Just imagine the students who have never used e-learning in past. If the system is not interactive they will struggle learning anything because they cannot understand the system. It is like if someone does not know how to read then it does not matter how many books you give him he will not be able to learn.*" Other respondent supported his view and commented that "I agree- interactive system make it easier for the students to learn. So having an interactive system is essential. If the system is complex then the learners will not be able to use it and hence they will not be able to get any aspect of e-learning. I am definitely in support of developing interactive systems." The respondent with teaching background commented: "*interactive systems are critical but I think we are limited by technology so that has to be kept in mind. I think that whatever interactivity is lacking in e-learning systems can be covered by other form of interactivity especially teacher. I*

mean even if the system is complex the teacher can help the student understand it and then no more interactivity is required."

Student-system interactivity and course effectiveness: Respondents suggested that system interactivity is not much to do with course effectiveness. One of the respondents commented "for me the system is not that important because whatever the system it cannot be so complex that I cannot learn it. The question is what after that?" Other respondent supported his view and commented that "I think subject outcomes are independent of system interactivity. I do not see the reason why system will be that significant factor. After all how complex can it be. If it is properly explained then that is it." Respondents suggested that as long as the system remains the same they will be confident of using it but the real problem can be when the system changes a lot.

Some of the respondents, however, disagreed. One of them commented that "for me it is quite essential to have an interactive system because I do not have very strong IT skills. For example, I know where to look for the information but if the information is not obvious then it becomes a problem. This is one issue that I must overcome before I can use any aspects of e-learning." Another respondent commented: "interactive systems are useful because it help the learners overcome a big fear that they have of using e-learning. Take for example, if the teacher is able to give live presentations and the students can attend it live it will help the students big time as compared to if the teacher posts videos for students to view at their leisure."

The respondents were unclear about the impact of student-system effectiveness in course outcomes but respondents did agree that having an interactive system is useful if not essential.

Student-system interactivity and independent learning skills: Most respondents agreed that having an interactive system would help in developing independent learning skills as the students will be able to explore the system themselves and overcome a major barrier in independent e-

learning skills. One of the respondents commented "*having an interactive system will definitely help in developing independent learning skills. Just imagine if the system is too complex how do you expect someone to use it independently.*" This view was supported by another respondent who commented that "*interactive systems will be easy to use so individuals can use those independently but of these are complex to use then everyone will struggle. In that case the major problem will not be learning but to learn how to use the system itself. If the system will be to complex then it will also make people stop from using it.*"

Other respondents supported their view. For example, F33 commented "interactive system are absolutely essential. I mean it is not about e-learning but everything. If the technology is complex then no one will use it. You can already see so much research being done in improving websites making them more interactive and all. So interactivity is definitely important for independent usage." Another respondent supported her view and commented "*it is necessary. Especially in countries like Saudi Arabia where many individuals are not exposed to interne and other technology like people in US have been. So having interactive technology will help these individuals to start using it. Don't expect someone to take special course for learning how to use technology.*" Indeed other respondents also agree that lack of prior exposure to e-learning is itself challenging for the students and on top if the system/ technology is complex it will simply put off people. Respondents also suggested that teachers and other actors within the system can help significantly in improving this interactivity, that is, they can teach the students how to navigate through e-learning systems, how to use those . This is contrary to Anderson's interaction Equivalency theorem as respondents indicated that the different kinds of interactions are complementary and not competing.

5.2.5 Student-Student interactivity

All the respondents agreed that student-student interaction is critical for e-learning. Respondents F21 commented: "I think it is quite important to allow the students interact with each other in e-

learning. It is important because it allows students to discuss their knowledge with others and that is important for knowledge." Respondent F45 commented "this is important. If the students are allowed to engage with each other they can all learn. I mean if I share my knowledge with others I not only improve their knowledge but also my knowledge." Respondent F26 commented: "*students contact with each other is important. IF it is not there then the student will be bored. It will be like watching a video and we all know that we cannot learn by watching videos. It is essential for us to discuss and socialise and learn by doing that.*" Several other respondents provided the same comments. Respondent F51 commented "*learning with fellows is very important. I think 90 percent of our learning is through our interaction with others and the same is in e-learning. Think about classroom, how much we learn through the discussions in the class and through discussions with other students in the class. If we can have the same thing in e-learning it will solve a lot of problem with many students because whatever problems we face we can always ask one of our colleagues to help.*" Another respondent commented "*discussion is important. We learn by challenging others and by others when they challenge our thoughts. This debate and discussion is a key part of our learning and one thing that I think most e-learning systems do not have.*"

This shows that e-learning is vastly different from classroom learning. The primary difference is that classroom learning is more interactive allowing the teacher to engage with the students. On the other hand, e-learning is ubiquitous, cost effective, flexible and allows access to a wide range of content. There is thus a trade off and the usefulness of e-learning can only be determined on the basis of how this trade off can be minimised. This can only be achieved by enhancing interactivity in e-learning. As commented by one of the respondents "*Interactivity affects accessibility a lot. If you offer me to study something in class for a fee and online for free then I would still choose classroom because I would learn so much more. Interactivity I believe has strong link with accessibility because if something is not taught interactively I don't think it is accessible.*" Another respondent commented: "*From learning perspective there are several differences. Classroom learning is more active and engaging. E-learning does give you freedom to learn but then it is really not that high quality. I mean I know students enjoy coming to the class, talk to friends and teachers. It is a combination of socialising, learning. Do you know how*

much we learn by engaging in discussion which cannot always happen in controlled environment such as e-learning or classroom. But classroom environment does allow for this discussion in engagement so I would say both have their benefits but I would still favour combining the two rather than saying that either this or that."

One of the respondents with teaching background commented "*student interaction is probably the single most important factor that is missing from e-learning systems. Students interact with each other in many ways and whenever they interact with each other they learn. It is a process which does not exist in e-learning systems, at least I can tell from my experience. This is the reason why I think hybrid system in which class and e-learning is used simultaneously are more effective because the students get to interact during the classes.*" Another respondent agreed and commented that "*one reason why e-learning systems will never be able to replace classroom is social interaction between students. Just imagine meeting someone face to face or meeting someone on skype. Do you think there is same level of interaction. I agree that there is no choice but at least have some kind of interaction even if it is online. Currently the only person the students interact with is the professor and that too not often.*"

Most respondents commented on this part and agreed that student-student interaction is critical for learning. Next the respondents were asked how interaction with other students affected their course outcomes

Student-student interactivity and course outcomes: In this case the respondents could be categorised in three categories; students who had no interaction with other students in e-learning group, students who had interaction with others in the e-learning group and students who had interaction with others in e-learning group but not because of being in the same e-learning group but because of being in the same class (hybrid model).

Most of the student who had no interaction with others reported that not being able to interact with other students was a significant barrier in their ability to learn about the subject. As one of the respondents commented "*I was often completely lost. Only person I could ask was my teacher and of course he is a human being and not available all the time. Also I think he was handling so many students that he could not focus. Sometimes I asked him question and he never replied and sometimes he would reply after two three days. If I had access to my group embers I could have clarified my doubts immediately.*" Respondent F55 commented "for learning anything- any subject, it is important to have interaction between the students. There is big role to play for the teacher as well as he can organise the course so as to improve interaction among students. For example they can have more group activities. We already see that happening so much in classroom so why not in e-learning." Respondent F22 commented "*there is definitely a gap between e-learning and classroom. I had experience of both and I can definitely say that I missed being able to discuss with others so to understand the concepts. I would rate my learning in e-learning at not even 20 percent of that I culd have learnt in the classroom and most of it is because I could not interact with other students.*"

Most of the students who were able to interact with others commented that they were satisfied with it. F21 commented "I learn a lot by interacting with others. I was studying a module in electrical engineering and the professor was based in Dubai, I think. But I was able to interact with other group members. I could ask them questions and they asked me. We kept in contact through whatsap and skype and I benefitted so much from them." Similarly respondent F54 commented: "I entered my Bachelor's with no experience of business management and then there were some guys who had some knowledge about the field. They helped me understand the basic concepts. We became friend and I even visited them in Riyadh. It was an amazing experience- I mean I spoke to them like friend for over a year before we actually met. I must say that I could not have performed well if I did not have their support." Thus, most of the respondents who have had experience of some form of interaction online with other students were able to learn more and were able to contribute to the knowledge of others as well.

Finally the third group of individuals who had learn in hybrid model. They also agreed that online interaction between students is critical. For example one of the respondents commented "*I had this module which was to be taught online and I knew all the class because I was studying them for other modules. We could interact online for the module and even during the lectures we had one window open where we could send messages to each other. So many times I asked my colleagues to explain something what the teacher said but I could not understand. It was fun and it was not difficult at all. We kept on chatting even after the lecture was over.*" Respondent F36 commented "*I used to communicate with many of my team members while the lecture was going on. I found it better than the class because here I could ask my friend anything about the module without disturbing the lecture. I think all of us preferred this and it was quite important that we all understood the concept.*"

In total the respondents indicated that student-student interaction critical for achieving high course outcomes.

Student-student interactivity and independent learning outcomes: Respondents indicated that student-student interaction is quite critical for developing independent learning skills. Respondent F12 commented: "if we have the ability to interact with others I mean if we now how to interact with our peers then we can continue to learn even after college. I know several blog writers I can talk to them and ask them questions." Respondent F52 commented: "*once formal learning is over we enter in world where our peers are our teachers. So if we know how to interact with the online we can continue to ask them question and develop our knowledge. If we don't have these skills then how can we will learn? Learning is not simply by reading something. Other people can help us in understanding it.*" This view was supported by F55 who commented: "*after university if we have to learn we have to develop relationships with unknown experts online. If we cannot interact with these experts it is difficult to learn. Reading is definitely one thing but unless we can engage in discussions and unless we can critically analyse information we cannot learn.*" Respondent F61 commented "*I think it is important because independent learning is not about learning without help but about learning informally. Support*

is still required and the support will be from other individuals like us who know about what we want to learn. If we cannot ask them then how do we expect to know?"

Thus the respondents agreed that student-student interaction is critical for development of independent learning skills.

5.2.6   Independent learning intentions

In this context respondents were asked not to talk about their professional development needs but rather about what form of interactivity could motivate them to continue learning online.

Respondents were then asked what form of interactivity would most motivate them to continue their learning online independently after they have finished formal education. Most of the respondents commented that student-student interactivity will be the main driving force. Respondent F13 commented "I would be interested in knowing people from my subject area. I already discuss online with lot of known individuals and some of them have now become my Facebook friends." Respondent F33 also expressed similar views: "*of course the desire to make friend with people from the same professional field and areas of interest. We all do that any way- don't we. For example, we have friend online who may be are interested in football.*" Respondents thus indicated that commonality of interest which can be nurtured through peer to peer interaction is a significant driver for the individuals to continue developing their knowledge. Respondent F45 supported this view and commented that "we often go to work or university and the main motivation is to meet people. We like to socialise and if meeting people from the same field is possible then I am sure more and more individuals will go online and socialise with people with similar interests."

Indeed the use of social networking sites indicate that individuals are already connecting with people from similar interest areas and engage in discussions online. It is difficult to understand the cause effect relationship here but indeed the ability to connect with other people does affect the actions of humans. Most of the individuals prefer to socialise and in this fast paced life online interaction is becoming far too common. Amidst such an environment increasing student-student interaction in e-learning could motivate people to connect online with people who can aid in their knowledge and skills development. A number of people already seek advise online but it is on a more ad hoc basis. However, e-learning has the potential to push this knowledge exchange even further and make participants more active in knowledge sharing and must be used accordingly to achieve this superior outcome.

The table below presents the distribution of focus group respondents in support or against the specific types of interactivities for each of the three outcomes

	Type of interactivity			
	Student-Student	Student-Content	Student-Teacher	Student-system
Course outcomes	Yes = 36	Yes =21	Yes = 33	Yes = 7
	No= 1	No =3	No = 5	No =18
	No comments = 10	No comments = 23	No comments = 9	No comments = 22
Independent learning outcomes	Yes = 41	Yes =27	Yes = 26	Yes = 16
	No= 0	No =4	No = 6	No = 4
	No comments = 6	No comments = 16	No comments = 15	No comments = 27
Learning behaviour	Yes= 21	Yes =4	Yes = 2	Yes = 0
	No=0	No =0	No =0	No =0
	No comments = 26	No comments = 43	No comments = 45	No comments = 47

Table 17: Summary of focus group results.

Based on the quantitative and qualitative analysis the final framework is presented in the figure below:

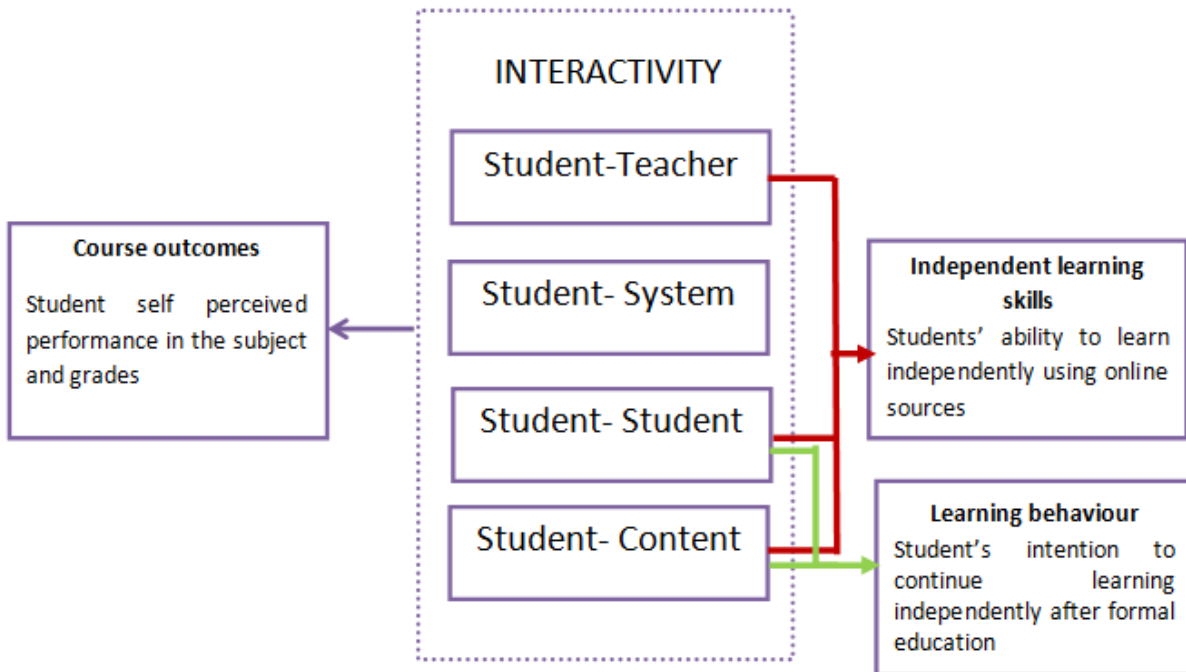**Figure 11: Final conceptual framework**

6. Discussion

6.1 Interactivity and e-learning effectiveness

This research looks at interactivity from a multidimensional perspective and provides recommendations on how it can be enhanced in order to enhance the overall quality of e-learning. This research supports the findings of past researchers who agreed that interaction is key to achievement of the goals of e-learning (Kuo, Walker, Schroder, and Belland, 2014; Croxton, 2014; Ozkan and Koseler, 2009), especially the pedagogical outcomes (learning (Dennen et al., 2007; Beuchot and Bullen, 2005; Garrison and Cleveland-Innes, 2005; Russo and Campbell, 2004).

This research finds that interactivity is essential for learners to engage with the e-learning system in both personal and technical terms. In other words, interactivity is critical for learners to learn from the teachers and other student and at the same time interactivity is essential for the learners to utilise the content and the system. This research, thus, supports the claim of Rochester and Pradel (2008) that interactivity has a significant influence on the overall learning satisfaction of the e-learners. This research also supports the claim of Croxton (2014) that interaction allows active engagement of the learner which is essential for not only his knowledge of the subject but also for the development of independent learning skills.

Focus group data indicates strong support for improving interactivity in order to improve overall effectiveness of e-learning. Respondents claimed that the primary difference between the traditional classroom model and e-learning is the lack of interactivity. Interestingly respondents also indicated that on the contrary, e-learning has the potential of increasing overall interactivity in the system because of its nature of freedom of learning.

Going by Harmon and Jones (1999) categorisation of the different forms of e-learning systems, this research finds that the most effective systems are immersive systems. Looking at Schone's (2007) categorisation of interactivity in e-learning as passive, limited, complex and real time, this research finds that real time interactivity is the most effective form of interactivity in context of e-learning. Consequently this research supports the argument that interpersonal interaction in e-learning should be two way and in real time rather than one way communication which is commonly used in e-learning systems. The respondents acknowledged the technical limitations in achieving this but argued that there is a possibility of using some web technology to develop e-learning solutions which will provide better interaction. Virtual classrooms are currently not used in Saudi higher education institutions and this could be one of the reasons for these opinions.

This research rejects Anderson's equivalency theorem and finds that all forms of interactivity are critical in e-learning effectiveness. On the contrary to Anderson's theorem that different forms of interactivity are complementary to each other. For example, this research finds that student-teacher interaction helps in improving student-content interaction because the teacher can learn more about the students and develop content which suits the needs of the students. Similarly, student –student interaction helps the student in improving student-system interaction as students can seek support from their peers on how to make the most of the system.

There are several learning models that could have been used in this research such as objectivism, constructivism, collaborative learning, cognitive information processing, and socio-culturism (Leidner and Jarvenpaa, 1995). However, the researcher believes that out of all these models constructivism is the only holistic model which looks at the true essence of learning. According to constructivism learners actively construct knowledge based of their sensory inputs. This combines most other theories and considers learners as active learners (Shang et al. 2001; Sims et al. 2002). This research is based on the assumption that e-learning has the ability of

transforming the temporary, dependent and formal learners into lifelong, independent, informal learners because it can provide the learners with all the tools and resources that a learner might need in order to construct knowledge.

6.2   Student-content interaction and e-learning effectiveness

This research finds that student-content interactivity is a significant predictor of overall interactivity in e-learning system. This confirms the findings of past researchers such as Gan (1998); Parker (1997); Carlson and Zhao (2004); Selim (2005); Silong and Ibrahim (2002), Zhag et al. (2004); Rosenberg (2001); Benigno and Trentin (2000); Poh and Abu Samah (2006). Interactivity in content is quite critical because the manner in which content is organised has a significant impact on the learning of the learners. Interactive content is easy to assimilate and understand and students are able to decipher the meaning within the content relatively easier. This research also finds that e-learning channel makes it easier to develop interactive content and in this manner interactivity and e-learning interplay. This research, thus, supports the findings of Kuo et al. (2014), Croxton (2014) and Ozkan and Koseler (2009) who argued that structuredness cannot replace interactivity.

This research also supports the findings of Lee and Rha (2009) that student-content interactivity is useful in improving independent learning skills in students as interactive content allows students to teach themselves.

In terms of construction the more interactive content is better is the ability of students to understand it and construct knowledge on the basis of this. In e-learning self construction of knowledge is quite essential. Because teachers are not able to deliver the complete content it is essential for the students to develop an internal ability to construct knowledge on the basis of the content. In this respect interactive content, which can speak for itself, is quite useful.

Content here refers to elements such as course material, learning objectives, activities, assignments, evaluation (Moore and Kearsley, 2005). This research finds that high degree of structuredness in content can improve the subject outcomes but are counterproductive as far as independent learning skills are concerned. As the respondents indicated structuredness make the student used to a particular learning style and dependent on the instructor for instructions. This is not useful if we wish to develop independent learners.

Several researchers such as Gorsky and Caspi (2005) and Moore and Kearsley (2005) have argued structuredness and interactivity are both critical to e-learning and hence content developers must make sure that there is adequate mix of the two in the content. For example, some basic concepts could be taught in a structured fashion to ensure that all the students have the necessary basic conceptual knowledge and further than that interactivity can be used to allow the learners to independently implement the conceptual knowledge at higher levels.

Use of technology to develop interactive content is a critical aspect of e-learning and this research confirms this aspect. Now, although students still spend time with their content, the advancement in technology has introduced many different types of contents to our lives like, reading informational texts, watching instructional videos, interacting with multimedia, participating in simulations, using cognitive support software, doing the assignment and working on projects (Abrami, et al. 2011). Distant educators should focus on choosing the appropriate content for the needs of the learner. This research finds that while there has been some emphasis on developing interactive content, one of the problems that most students face in case of e-learning is the amount of content available. Indeed, one of the benefits of e-learning is the vast amount of information that it provides on the students and students who are capable of identifying relevant information have better ability to succeed with e-learning. In this context the respondents also mentioned about the role of teachers which is discussed later in this chapter. Several researchers have supported the view that well structured content can replace teacher-

student interaction to a significant extent (Lee and Rha, 2009; Ostlund, 2008; Lee, 2004). However, this research concludes that in the short run teacher-student interaction complements the student-content interaction. But once the student is out of the formal education system, student-teacher interaction ceases to exist or exist only partially and in that case student-teacher interaction may be replaced by student-content interaction to certain degree. However, it is not possible for either of these interactions to completely replace each other.

Respondents indicated that it will be useful if the content is interactive so as to develop the skills in the students. For example, instead of exam based system, a coursework based system could be introduced where the students can independently select a coursework based on their own interest area within the specific field. This is applied to certain degree in western education institutions where the students undertake independent research project but is not extensively used in Saudi education system.

Student-content interactivity is quite essential in context of e-learning as compared to classroom learning because the interaction between students and content occurs somewhat independently of any intermediaries such as teachers (Lee and Rha, 2009). This independently occurring interaction makes it quite crucial to develop interactive content. In terms of exploring the interactivity of the content the role of intermediaries does exist. However, for development of lifelong learning ability it is essential that learners are able to construct knowledge and interactive content plays a significant role in this regard. Next question was what constitutes interactive content. Content which is elaborate and self explanatory is considered interactive. Also the learner should be able to modify this content according to his/her preference. In this regard, developing authentic content database which can be relied upon is quite essential. It is quite difficult to develop content which can be catered according to user requirements but what the users can do is identify and access information as per their own preferences was suggested as one of the solutions to developing interactive content. In terms of interactivity in content users highlighted the significance of not only what is presented but also how it is presented. This aspect of content interactivity is overlapping with system interactivity which is discussed later in this chapter.

6.3 Student –teacher interaction and e-learning effectiveness

Teacher- learner interaction has been a focus of many studies in past (Beuchot and Bullen, 2005; Garrison and Cleveland-Innes, 2005; Novitzki, 2005; Dennen et al., 2007; Kehrwald, 2008; Weaver, 2008; Lee and Rha, 2009). This research finds that student-teacher interactivity is one of the most critical forms of interactivity in e-learning effectiveness (Magjuka et al., 2005). Student- teacher interaction includes the direct and verbal communication/ engagement between the two. This is interpersonal communication which occurs between the teacher and learner in and outside the context of the study (Lee, 2004b). Some of the respondents agreed with Su et al. (2005), Mazzolini and Madison (200) and Dennen (2005), who argued that while student-teacher interaction is useful to certain level, too much of this interaction is not desired by e-learners. According to these respondents too much interaction by the teacher will hinder the independent learning skills development and the students will eventually become dependent on the teacher. Most of the respondents however, disagreed and supported the view of Moore (2004) who argued that Student-teacher interaction is the single most critical aspect of classroom model.

Teacher's role in e-learning is considered to be that of developing rich and interactive content (Muilenburg et al. 2005). However, this research finds that teachers play a central role in e-learning and act as mediator for most other types of interactivity. For example, teachers guide the learners on how to use the system and in this manner they improve student-system interactivity. Similarly, they do not only provide rich content but also assist the students in accessing the content appropriately and in this manner teachers also facilitate student-content interactivity. Finally, by appropriately designing the course the teachers influence student-student interactivity. This research thus supports the findings of Martinez-Molina et al. (2008) and Abulibdeh and Hassan (2011) that teacher-learner interaction can improve other forms of interactivity in e-learning.

The respondents provided an interesting insight into heavy focus on structured content and low focus on interactivity in Saudi higher education institutions. This research thus supports the view of Dennen et al. (2007) that some teachers lack the skills of teaching in e-learning environment. This does not mean that they lack the knowledge of their subject but that they have not had sufficient experience as a learner in e-learning environment and are thus fluent in providing information efficiently, and effectively in e-learning channel. According to several respondents, the teachers themselves have had little experience of using e-learning as a tool as a student. They do not understand students' perspective in e-learning. For them teaching is mainly on instructivist lines rather than on constructivist lines. These teachers, due to their lack of knowledge of using e-learning tend to use it as an aid in delivering the content. In order to compensate for perceived low level of interaction in e-learning they tend to compensate this by providing very detailed and structured content. This argument seems reasonable considering that e-learning in the Kingdom was adopted recently in 2006-07 and is still in development stages. It is quite possible that several professors teaching in Saudi higher education institutions may not have had the high level of interaction with e-learning. In order to overcome this problem the respondents suggested that the teachers teaching e-learning courses should have some sort of certification of teaching e-courses. This certification would ensure that they realise full benefits of e-learning and are able to follow a constructivist approach in e-courses as compared to the instructivist approach they are currently adopting.

Martinez-Molina et al. (2008) suggested that teachers can improve the overall effectiveness of e-learning program by providing feedback to students. Several respondents confirmed his view that teacher's feedback remains a key constituent of their learning process even in e-learning. Most of the students exhibited preference for direct face to face contact with their teachers rather than online interaction. According to the respondent it is much easier for them to understand when anything is explained face to face. It could be because direct face to face communication affects our subconscious learning. Most of the respondents suggested that they would not enrol for a completely online course because of the lack of direct interaction with the teachers, which they believed will affect their learning. These findings confirm the findings of Hrastinski (2008) that lack of direct interaction is one of the key factors of poor adoption of e-learning.

Respondents agreed that teachers are facilitators of knowledge in e-learning. They undertake several critical activities which affects the overall effectiveness of the course. For example, the respondents suggested that the manner in which the teacher designs the course can have a significant impact on student's learning. Respondents suggested that student-teacher interaction is even more critical in e-learning than in classroom learning there are several other elements in the class which can partially substitute for a teacher's interaction. For example, students can discuss with their peers. According to Gibson (2002), teacher's role in e-learning system changes from "centre stage" to "guide on the side". However, in e-learning, teacher remains, to certain degree, central to the whole process (Wallace, 2003). Like a controller he adds the right ingredients at the right time to ensure that the students have overall effective learning.

This research thus supports the view of Moore, who, in his transactional theory posits that for a decrease in transactional distance education, communication between students and teachers must become more frequent. This research supports the view that while teacher remains central to the whole e-learning process but the role shifts from active instructor to a facilitator and finally as a motivator. The transformation in the teacher's role occurs as the leaner gains the skills of the subject and the whole e-learning process. Teacher's interaction is required to assess the needs and requirements for each learner at each stage of their constructivist learning development cycle.

6.4   Student-student Interaction

This research finds that student-student interaction is the most critical aspect of interactivity in online learning. It has been found that it is one of the most ubiquitous and common form of interaction available in traditional classroom model and one that is mostly absent from online

models of learning. Students through this interaction learn from each other, find solutions to their problems that they face in their studies and work together to find a solution to them (Wei, 2009).

Learning is an active process and in this approach it is achieved through engaging actively rather than the traditional passive approach. Student are expected to make something new from the information and the knowledge that they are given and not merely take the new ideas and concepts that are given to them by their teachers. The richer the context the more effective is the learning. Learning is effective if the learners are asked to solve a problem and education is based on students' activities. Teachers pose the students with questions and problems and the students starts their activities by solving this challenge that is put in front of them. Learning on the other hand is a social process, which in collaborative learning happens through communication. This confirms the findings of Smith and MacGregor (1992) that an "intellectual synergy" of ideas is created when students propose their thoughts to one another and have to do so to get the desired outcome.

This research supports the findings of Abulibdeh and Hassan (2011) that interpersonal interaction is essential to enhance effectiveness of e-learning as knowledge construction cannot happen in isolation with the environment of which other individuals are key players. Social interaction plays a vital role in our cognitive process of learning and student-student interaction is one of the most significant ingredient of our learning process. We learn socially- we exchange information in formal and informal ways which help us in not only constructing knowledge but also learn the skills of knowledge construction. For example, when we see someone reasoning or building argument we learn. Often this learning is in our subconscious mind and often slow and hence it is not immediately recognised. However, it cannot be disputed that individuals learn through interaction with each other and it remains true in context of e-learning.

The effectiveness of e-learning as confirmed in this research rests in the learner's ability to construct the knowledge independently. In this respect all the forms of interactivity were found

to be a significant contributor. What was found to be the most significant form of interactivity as far as construction of knowledge is concerned is the student to student interactivity. Student-content interactivity helps the students in accessing content in the most effective manner. But student-student interactivity helps the learners through intellectual stimulation. This stimulation is found to be quite critical for e-learners because other forms of stimulants cease to exist after some time.

One very interesting observation in this research was that student-student interactivity was found to be even more significant as compared to in the classroom model. This is so because in classroom model, there are other forms of stimulants available. Furthermore, classroom learning teaches learning through content and instructor. The lack of interactivity in e-learning systems make it even more significant to bring in whatever form of interactivity can be brought in. According to the respondents it is not possible to have the same learning environment as the classroom because the whole environment is targeted towards teaching and learning. However, in e-learning system, the learner has to self create this environment. Peer-to-peer discussion can be quite helpful in this regard.

This research supports the views of Dewey (1966) and Bruner (1986) that learning is a social and communal process which involves sharing of culture. It is an extension of our social lives and individuals learn from each other than they can ever learn through any formal education. Piaget suggested that constructivist construct their knowledge; the learner actually invents and reinvents it over and over as through their interaction with the world. Learners accordingly engage with their environment actively and acquire knowledge through it. In the whole process of assimilation, accommodation and equilibration, student-student interactivity plays a vital role.

This research finds that student-student interaction is even more critical in terms of constructivist learning because once the student is out of the formal education system, his/her main source of information is the peer network. With social media individuals are actively growing their social

network and seeking communication with individuals with similar interest areas. This opens up a range of possibilities for active learners who can reach out to potential experts using several networking tools available and seek information. This would help create community where individuals are informal learners and teachers and where an active exchange of knowledge takes place. This would lead to an overall enhancement of the knowledge of the community. However, as this research finds, this has to practice has to start with the e-learning courses, where the instructors and content can guide and motivate individuals to learn from their peers. A very well designed program will motivate individuals to reach out to experts outside their social network and learn the skills to seek knowledge. In this respect, student-student interactivity is quite critical to e-learning, both in terms of course outcomes as well as in terms of independent learning skills development.

6.5   Student-system interaction

This research finds that one of the problems that higher education students in Saudi Arabia find is their lack of knowledge of using e-learning systems. In western education system e-learning is introduced from early stages of education equipping the students with necessary skills to interact with the system. However, e-learning in Saudi Arabia is a relatively new phenomenon making it difficult for the higher education students, who have had no experience of using e-learning systems in their secondary education, difficult to use. This is the reason why the role of student teacher interactivity becomes quite critical. Some respondents suggested that there might be a possibility of training the higher education teachers in effective e-learning.

In terms of technology, it was found that greater student-system interactivity will reduce the cost of effort that the students may have to invest in using the system making it easier for them to focus on the learning itself. Some respondents suggested that e-learning institutions are looking to develop e-learning systems in participation with the students to make sure that system facilitates learning and not prove to be a barrier. Most students suggested that system is only

partly interactive and there is still a lot of scope of improvement as far as improvement in system side is concerned. For example, one of the students suggested that there were lot of problems in live feed sessions and also in some cases playback was not possible. The delay in communicating with the teacher means that the communication was not real time so if the system hanged for even a second the whole chain of communication breaks with no possibility to reverting back. It was also noted that institutions are using some old infrastructure which does not support the large number of live feed connections that are required. This leads to lag, delay etc. which affects individual's experience and his overall learning.

6.6   Constructivism and e-learning

Research concurs that constructivism is a great approach for e-learning because is ensures that learning happens. It supports the findings of Mödritscher (2006) that constructivist learning is the most effective form of e-learning. Constructivist leaning environment reflect the complexity and diversity of life in their approach. Not all principles that are considered general necessarily apply to everyone in a particular situation. This is because people are different in so many ways because of the different social backgrounds that lead to varied perceptions. Constructivists welcome these varied perspectives (Duffy and Cunningham, 1996; Honebein, 1996). The diversity of perception is expressed through negotiation among the learners. Spiro (in Driscoll 2000: 380) states, "revisiting the same material, at different times, in rearranged contexts, for different purposes, and from different conceptual perspectives is essential for attaining the goals of advanced knowledge acquisition." Additionally, he proposed that hypermedia provides the necessary tools for this. It be used to encourage construction of new ideas, theories, literary works or whatever, from several different perspectives (Cunningham, 1992). They can also build a systematic knowledge base that allows the exploration of the multiple interpretations. Reviewing the same content through several different modes allows for different aspects of it to

be revealed. Cognitivists support the idea of multiple modes of delivery of instruction in classrooms (Driscoll, 2000).

Since the Constructivist theory is based on the idea that learners construct their own meaning to learn, it is necessary for them to take responsibility of their own learning and develop autonomy as well as content. They need to be given the freedom to chose and negotiate the content and work by themselves on it. To achieve this, teachers must establish their role as a facilitator to coach and students must be encouraged from the beginning to reflect, investigate and apply the content.

In most educational setting the teacher plays a role beyond observing and assessing, they help facilitate discussion and engage the student as they perform their activites, they pose questions to promote understanding and reasoning. Constructivists view the teacher as an advisor or a facilitator and the active learner as the centre of the process. Teachers will help the learner to use their embedded background and culture to discover their own version of the truth (Hung, 2001).

Learning should be an active process where learners do high-level activities. Teachers must engage students in activities like trying to apply the information to a practical situation, facilitating personal interpretation of learning content, discussing topics within a group, assessment and so on. Experiences and social interactions play a role in the learning process (Anderson and Elloumi, 2004).

According to the Constructivist pedagogy, the learner and not the tutor is the centre of the learning experience. In e-learning, it is difficult to maintain the role of the tutor all the time but it does provide the student with all they need making it more student focused. Students have the choice to study what they want, where they want, how they want and also with who they want to

study with. Therefore Internet based learning accelerates the process of a shift to a student centred learning experience.

Looking through a constructivist point of view, the achievement of these conditions will be impossible to replicate merely with books. The learners need to be liberated from the confines of the books by teachers and instructional design, especially in the case of language learners from the rigid and restrictive rules of grammar and classrooms is even more important.

6.7   Usage of e-learning

This research finds that most institutions are using e-learning model to complement their classroom model. Complete e-learning courses are not yet common in Saudi Arabia and one of the reasons cited by the students is that the poor quality of education in e-learning leads to less interest in e-learning model. This contradicts the views of researchers who suggested that e-learning is gaining acceptance as an alternative of classroom model. One of the reasons of this contradiction can be that most of this research was carried out around a decade ago when e-learning was in infancy in the Kingdom. At that time, internet was still picking up pace and a very small proportion of the population had access to high quality internet access. Researchers like Arbaugh were purely speculative in the sense that they expected internet to grow very rapidly and transform the traditional education model. This however, indicates that there is indeed a possibility of using e-learning as alternative of classroom model. However, this research finds that there has been limited use of e-learning model in Saudi Arabia as complementary to traditional classroom model. This research also finds that this gap is mainly due to lack of interactivity in the e-learning model.

Time and place flexibility is the primary reason for adoption of e-learning by students while for institutions, lower financial costs is found to be a significant reason for adoption of e-learning.

This confirms the findings of Coleman (2012) who suggested that anywhere/anytime learning is a significant motivator for students to adopt e-learning model. However, Coleman (2012) also suggested other factors that drive students' adoption of e-learning such as increased student interaction, acquiring skills in using technology, and instructors being more approachable. This research indicates that lack of interactivity as the primary cause for lack of these aspects in e-learning. In terms of acquiring skills in using technology, this research finds that e-learning providers consider this as prerequisite for using e-learning. In other words, e-learners consider this as a prerequisite rather than an outcome of using e-learning. Due to this reason, adoption of e-learning model has been sluggish for many non technical subjects. Furthermore, this research finds that current model of e-learning is actually beneficial in delivering education in non technical subjects because of the level of interaction required. This indicates that there is inconsistency in the approach of e-learning providers. This research also finds that current model of e-learning is mainly focused on facilitating interaction between student and content but insufficient attention is paid to teacher-learner and learner-learner interaction. These two forms of interaction are quite critical in improving the quality of learning. According to Coleman (2012) these two forms of interactivity is quite critical for students' adoption of e-learning model and lack of these two could explain the lower adoption levels for e-learning model as compared to classroom models.

This research finds that organisations are using both asynchronous and synchronous models of e-learning although the former is much commonly used. According to the respondents, the primary reason for lack of adoption of synchronous model is technical limitations which prevent the students to remain connected throughout the lesson. One problem with these technical limitations is that in most cases the providers go for asynchronous model of e-learning which lacks teacher-learner and learner-learner interactivity. However, recent data indicates that high speed broadband penetration is on the rise in the Kingdom; Saudi Telecom Company reported that fixed line high speed broadband penetration has increased from 4 percent in 2005 to 22 percent in 2014. In addition, Saudi Arabia has 50 million mobile phone connections most of which have mobile broadband access through 3G and 4G LTE technology. These technology provide high data transmission speed which has made it easy to stream live videos. This should have

overcome any technological barriers that e-learning provides have in interacting directly with a number of students. However, the current e-learning providers are still using the old asynchronous e-learning model which lack interpersonal interactivity.

6.8   Chapter summary

This chapter presented the review of the findings of this research. The findings from the qualitative and quantitative data analysis were triangulated and compared with the findings from the literature review. This research finds that interactivity is essential for learners to engage with the e-learning system in both personal and technical terms. Not only does it make the instruction provided in e-learning more effective but it also allows the learners to utilise the resources, system and content more effectively. This in turn allows the learners to learn about the subject as well as develop independent e-learning skills and capabilities. This research finds that e-learning has far more potential as compared to traditional classroom learning because it allows the learners to develop skills for lifelong learning. Conventional classroom are mainly instruction based which means that the learning of the students is somehow limited (or is only work experience based) after the students leave formal education system. E-learning, however, can give the students skills which will allow the students to continue their learning process independently for the rest of their lives.

This research finds that all four forms of interactivity influence the effectiveness of e-learning. These are complementary to each other but unlike what Andersen suggested in his interaction equivalency theorem, the four kinds of interactivities cannot be used a replacement of each other. It is thus essential for the system to be holistically interactive. This research also supports the constructivist approach to e-learning as an effective approach as it not only gives the students required knowledge but also skills to be independent learners.

In terms of student-content interactivity it is essential for the teaching community to develop interactive content. Also skills such as filtering the relevant content from the vast amount of information available online as well as aspects such as validity and reliability of information

available online should be taught. Student should be able to interact independently with the content for the content to be considered interactive. Appropriately designed content can help the students in developing skills which will help them in becoming independent e-learners.

This research finds that student-teacher interactivity is one of the most critical forms of interactivity in e-learning effectiveness. Teacher's role in e-learning is to make the content more understandable and teach the student how to decipher the meaning of information presented online. For this the teacher need to interact continuously with the students. Student-teacher interactivity also influences other forms of interactivity such as student-student and student-system interactivity. This research recommends that teachers should use constructivist approach when teaching in e-learning but the most common approach currently being adopted in Saudi e-learning courses is instructivist approach. Part of this can be blamed on the poor teaching capabilities of teachers who have experience of teaching in traditional classrooms. This means that teachers should be given specific training on e-learning skills. Unlike in traditional classroom model, in e-learning, teachers must try to play the role of a facilitator rather than taking the centre stage.

Student-student interactivity plays a vital role in e-learning because students learn from variety of available resources, one of them being their peers. Constructivist learning occurs through social exchange of information between different actors. This can only happen if student-student interactivity is promoted. Constructivists construct their knowledge; the learner actually invents and reinvents it over and over as through their interaction with the world.

Student-system interaction is found to be quite critical in e-learning as well because it not only affects the overall experience of the individuals but also affects his/her perception about it being the most suitable method for future learning.

Chapter 7 Conclusion

7.1 Research summary and key findings

This research aimed at analysing the impact of interactivity on effectiveness of e-learning.

This research primarily aimed to understand the following:

- Identifying the different forms of learning: The literature review section involved study of different learning models which can be applied to e-learning context. Blended learning model is the model in which the students are self directed learners. This relates to the theory of constructivism in which the learners are also constructors of knowledge. It is recommended under the blended learning model that teachers should focus on empowering the students by providing them skills by delegating power to the students. Research also indicates that mere adoption of internet as channel for delivery of education will not result in better outcomes but for this to happen computer based programs should be more student-centred in their methods of instructions. Authentic learning is characterised by "authentic context, authentic activities, collaboration, reflection, access to expert performance, multiple roles and perspective, articulation and authentic assessment." In this model emphasis is on collaboration and teamwork and even the assessment is not conducted conventionally through essays and exams but rather through diagnosis, reflection and self-assessment. Active and passive learning models are discussed. E-learning as the potential of turning learners into active learners because they have access to all the tools and resources that they need for their learning. However, it is the responsibility of the teachers to turn them from passive to active learners. Finally deep and surface learning models are discussed. Surface learning here refers to learn what has been taught and nothing more. Deep learning refers to learning in-depth where the learner explores more and learn more, beyond what has been taught to him/her by the

teacher. In context of this research the learning which is blended, authentic, active and deep is effective learning.

- Understanding the concept of effectiveness in e-learning: Effectiveness in e-learning is much more than simple evaluation of the grades that the students scored. This research finds that effectiveness of e-learning rests in development of skills related to independent learning. Past approaches to e-learning have been quite restricted in that they have been focused on and have been evaluated on the basis of the impact on the overall subject outcomes. This, according to the researcher, is a narrow view of the aim of e-learning. With increased adoption of internet and ubiquity of internet enabled devices most individuals have access to e-learning content online. Amidst such a technologically empowered environment e-learning providers should strive to increase the focus of learning and transform it from formal and institutionalised process to informal, independent and life long process. This can be achieved by focusing broadly on teaching the students skills to become independent learners. For example, by teaching them how to ask the right questions, how to search for the information, how to access and assimilate the information independently and how to interact with experts from the field. This will broaden the scope of e-learning and will provide immense benefits to the human society. For providers and policy makers this would ensure that they can develop a knowledge seeking and aware society.

- Understanding what are the different forms of interactivity in e-learning. E-learning environment requires the learner to interact with a number of elements. Identifying these elements was essential in order to understand how each and every form of interactivity may affect learning of individuals in e-learning. This is essential so as to be able to develop practical solution n the basis of this research. For example, the researcher finds that student-student interactivity is quite critical in effectiveness of e-learning. This would help the e-learning course providers in ensuring that student-student interaction is considered as a key component of their online courses. One of the problems with past research has been that the researchers have provided recommendations which are academically useful but not so practically useful. For example, while researchers talk about interactivity being critical for e-learning but they have not empirically investigated

this relationship so to be able to develop practical recommendations on how effectiveness of e-learning can be improved by improving interactivity. This research thus, went a step further and looked at what kinds of interactivity are useful for improving effectiveness of e-learning and furthermore, investigated the nature of this relationship.

- This research also highlighted the need to find the balance between independent and instructed learning. This is quite critical because it is often highlighted that e-learning eliminates several key aspects of classroom learning. E-learning is a superior form of learning only if it includes the interactivity aspect of classroom learning. Merely providing students access to a large amount of learning resources will not result in learning but it is rather the combination of both the content as well as sharing of the content which is critical. Students need only content but sills to learn how to use this content i.e. how to construct the knowledge based on this content.

- This research also highlights somewhat unique challenges that higher education students in Saudi Arabia face while using e-learning. One key challenge is relative lack of knowledge of using e-learning because in secondary schools e-learning is not as commonly used as in some of the western nations. This newness to e-learning can be quite challenging for some students because they are burdened with not only learning higher level things in their subjects but learning it in a manner which is new to them. This puts the teacher into the centre of the learning process as he/she must facilitate the learning process for the students. This means that the teacher not only needs the subject skills but also the skills of how to develop constructivist learning in students. This means that the teachers requires deep knowledge of the usage of e-learning resources. The problem is that the current stream of teachers, especially the subject experts who have been teaching for decades in the higher education institutions may not have the level of knowledge required for imparting e-leaning skills.

This thesis is presented in six chapters. The first chapter provides an overview of the research problem. It provides the reasoning why it is essential to investigate this phenomenon and the contribution of the research was discussed. It was clarified that most of the past research has provided a limited insight into how interactivity affects effectiveness of e-learning. This thesis

looks at how different forms of interactivity affects effectiveness of e-learning in Saudi Arabian higher education students. Chapter 1 also contained the aim and objectives of this research along with the research questions that this research aims to answer.

Chapter 2 presented a thorough literature review on the subject of interactivity and effectiveness of e-learning. This research is based on the theory of constructivism and the significance of constructivism in e-learning is discussed. Competing theories are also discussed and reasoning provided for why constructivism is the most suitable model for e-learning. This chapter also discussed in detail the different kind of interactivities that exist in e-learning. For the sake of simplicity this research categorizes e-learning in the following four categories- student-teacher, student-student, student-content, student-system. At the end of the chapter a conceptual framework is presented summarizing the findings of the literature review. This conceptual framework was used to form the questionnaire and was the basis of data collection and analysis.

Chapter 3 presents an overview of the research methodology and data collection procedures adopted. This research was completed in three stages. The first stage began with an extensive literature review which helped the researcher in identifying research gaps and in developing the conceptual framework. The second stage of the research involved a self administered structured questionnaire survey. The survey was designed to test the conceptual framework in context of Saudi Arabian higher education institutions. It investigated the relationship between different forms of interactivity in e-learning and effectiveness of e-learning. This chapter outlines the questionnaire development and administration process. It discusses why questionnaire survey was preferred method of data collection for this stage. The findings of the questionnaire survey analysis were used to test the conceptual framework. In the third stage of the research, the researcher conducted focus groups. Focus groups were aimed at obtaining greater insight into the findings of the questionnaire survey and to identify possible solutions to how interactivity can be improved in e-learning system. This chapter discusses the benefits of using pragmatist philosophy and mixed methods for this research. Data collection procedures, sampling and

limitations of survey and focus group methods are discussed in detail. In addition, validity and reliability of the data collection methods adopted in this research are discussed.

Chapter four of the research presented findings of the data analysis. This chapter is divided in two parts. The first part presented the statistical analysis of the questionnaire survey. Regression results are presented and a brief discussion is provided. Section two of this chapter presented analysis of the focus group data. Data for the focus group is analyzed according to the themes identified according to the conceptual framework. Results indicated that student-teacher, student-student and student-content interactivity is significant predictor of effectiveness of e-learning at 5% margin of error while student-system interactivity is significant predictor of the effectiveness of e-learning at 10% confidence level only. The findings of the focus group revealed how interactivity affects learners' ability to construct knowledge. The main measure of effectiveness of e-learning is whether individuals develop the capability of constructing knowledge on their own i.e. without any form of instruction. Focus groups were aimed at understanding what challenges Saudi higher education students face in le-learning and how they believe e-learning can be made effective in terms of developing their skills in construction of knowledge. The findings of focus groups indicate that lack of prior knowledge of using e-learning is a challenge for most of the students. Consequently they recommended that universities should hold a thorough induction program which will help enhance the student-system level of interactivity. According to the students, student-system interactivity is a prerequisite for e-learning but once achieved, this may not have a significant impact on the effectiveness of e-learning. Other three forms of interactivity i.e. student-student, student-teacher and student-content remain critical in effectiveness of e-learning. Student-teacher interactivity is critical in developing ability to develop knowledge construction skills while the learners are undergoing formal learning. Student-student interactivity is the one which is supposed to continue to assist he learners once they are out of the formal learning environment. Findings of focus group also revealed that the role of teachers is quite critical and in this respect how they organize the course and how they deliver it. Teachers are responsible for organizing the delivery of the course and it is often up to the teachers to make use of the system and resources at their disposal.

7.2   Research answers

The first research question was: what do we mean by effectiveness of e-learning? This research fins that effectiveness of e-learning is much broader than what has been conceptualised in existing research. This research finds that scope of e-learning, unlike traditional classroom model, is not restricted to learning about the subject only. Instead e-learning can provide independent learning skills to the learner allowing them to become independent learners. Thus, effectiveness of e-learning need to be measured in terms of both knowledge and skills. The effectiveness of e-learning is thus measured across three measures. First measure is how effective has been the subject knowledge of the learners as result of e-learning. Thus, course/subject outcomes are the first measure of effectiveness of e-learning. Second measure is whether the students have skills to learn independently. In terms of independent learning there are several aspects that need to be taught such as identifying the topic to learn, findings sources online, filtering the relevant information, compiling the information and building understandable arguments based on the information. The whole process involves several steps because the researcher is more in control of the information sought unlike in classroom model where the learner has to learn from a restricted number of sources. Thus, building independent learning skills is the second measure of effectiveness of e-learning. The third and final measure of effectiveness of e-learning is the motivation /desire to learn independently. This research finds that the scope of e-learning is not only about giving people skills and knowledge but also to motivate them to learn independently. In this respect e-learning takes away a key barrier i.e. access to information. Thus, the third and final measure of effectiveness of e-learning is motivation of learning independently.

 Then the second research question is what kinds of interactions exist in e-learning environment. This research finds that there are primarily four kinds of interactions in e-learning. These are learner-learner, learner-teacher, learner-system and learner-content. All these four have been discussed in this research. Indeed, there are other forms of interactions in e-learning as well. For example, teacher-system interaction is significant because teacher's interaction with the system

allows the teacher to achieve the aforementioned measures of e-learning. However, this research is focused on learner centred interactions. This is because this research finds that e-learning should be a user centred system because it is all about independence of learners.

The third research question is what sort of link exists between interactivity and effectiveness of e-learning. This research finds that the relationship between interactivity and e- learning is strong and complex. For example, not all forms of interactivity impact all measures of effectiveness of e-learning. However, this research finds that improving interactivity holistically in e-learning systems can improve all the three measures of effectiveness of e-learning.

The fourth and final research question is how can improving interactivity impact the effectiveness of e-learning? According to this research, improving interactivity will impact effectiveness of e-learning in multiple ways. The most significant impact of improving interactivity will be that the students will become more active learners which will help us maximise the benefits of e-learning. It also redefines the role of the teachers as enablers. This allows us to use our resources such as teachers more effectively. Finally it ensures that we achieve our long term and short term goals. Sort term goals refer to the knowledge of subjects while long term goals refer to improved skills and motivation for e-learning.

7.3 Key achievements

The first achievement of this research is that it proposes an approach to evaluate the effectiveness of e-learning. Evaluation of effectiveness of a program such as e-learning is quite essential because of three reasons. Firstly, the amount of money that is being put into these programs around the world call for an evaluation of whether this money is being invested properly or is being wasted. Secondly, as argued later in this research, e-learning has immense potential of working towards the betterment of the human society as a whole, even more than formal education institutions. In this respect evaluating its effectiveness will help us maximising our returns from the time, money and efforts being invested in developing this system. E-learning is still a new form of learning and evaluating its effectiveness in the beginning will help

us develop the system so that it provides adequate benefits. This is essential to do now because if not done at the initial stages the system might become so established that it might become difficult to change it. Considering all these three reasons, the researcher believes that evaluating the effectiveness of e-learning will provide far reaching benefits.

Leung (2003) recommends that evaluation of effectiveness of e-learning at earlier stages, that is, before its large scale adoption is quite useful in order to identify its strengths and weaknesses and address them accordingly. While the researcher supports Leung (2003) views but the researcher extends his recommendations and recommends that evaluation of effectiveness is essential in order for us to understand how to best implement it in order to maximise the benefits to the human society. Thus the researcher supports the views of Reeves and Hedberg (2003) that evaluation of e-learning should be aimed at developing the program i.e. identify how to design and implement it to maximise its benefits. Thus evaluation is useful only if it informs our decision making. This research thus aimed to provide practical recommendations on how to improve the design and implementation of e-learning programs. These recommendations are discussed in section 7.4.

This research empirically established a link between different forms of interactivity and effectiveness of e-learning. Past research has spoken about impact of interactivity on effectiveness of learning but the researchers have either not considered different forms of interactivity or have not used appropriate measure of effectiveness of e-learning. This research includes the constructivist approach to measure effectiveness of e-learning. This research is a valuable starting point for practitioners looking to implement full scale e-learning courses. Lack of interactivity is one of the reasons why e-courses have not been as successful. Yet, there is little debate over the benefits of e-learning. These are not only cost effective but also allow learners to learn without worrying about several intermediate barriers. This also allows universities to provide a range of courses without investing significantly in its infrastructure. However, the benefits of e-learning have not been realized as most learners still consider classroom learning to be more effective and consequently e-courses have suffered from lower subscription. By improving interactivity in online learning the pedagogical gap between e-learning and classroom learning could be filled and this is expected to increase interest in e-courses.

This research also highlights the criticalness of the role of teacher in e-learning. This research highlights that teachers role is critical because he facilitates learning of the student and helps them in achieving skills which helps them in achieving their goals from e-learning. Teacher not only organizes the content but also plan the delivery of the course in a manner which assists students in developing key e-learning skills. The role of teacher is thus, not only about delivering the content but in assisting the students in accessing the content independently.

This research also highlights that higher education students in Saudi Arabia face unique challenges in utilizing e-courses because of their lack of prior use of e-learning. Thus, adoption of e-learning is likely to increase when it is included at lower education levels such as during secondary education. This will help the individuals overcome a major barrier of technological sills which are prerequisite for using e-learning.

The methodological contribution of this research is the use of mixed methodology. The positivist philosophical paradigm adopted by most of the past researchers has been somewhat limited the usefulness of the past research. While the quantitative methods helps objectively establishing a link between different forms of interactivity and effectiveness of e-learning, the use of qualitative methods revealed the nature of this relationship and also how interactivity can be improved in e-learning. The pedagogical perspective cannot be explored completely without the use of qualitative methods and in this regard this research makes a useful methodological contribution. The use of focus group allowed the researcher to critically validate and enhance the theoretical framework. Furthermore, focus group data allowed the researcher to reflect on the findings of the questionnaire providing validation as well as useful insight for readers to understand the framework in more detail. Finally, the focus group interviews allowed the researcher to provide practical guidance for increasing interactivity in e-learning. This research thus recommends using a pragmatic philosophical position and mixed methods approach to investigate how to increase interactivity in e-learning.

7.4   An overview of findings of the research

7.4.1   Student-student interaction

This research confirms the findings of previous research that student-student interaction has a significant influence on the effectiveness of e-learning. Student-student interaction helps the learners create the same social environment that they experience in classrooms. Furthermore it improves collaboration and peer based learning which is quite critical for learners to become lifelong and independent learners, the two main objectives of constructivist approach to learning.

7.4.2   Student-system interaction

This research finds that student-system interaction is a significant predictor of effectiveness of e-learning at 10% margin of error but not at 5% margin of error. The focus group data reveals the primary reason behind this. According to focus group respondents student-system interaction is a prerequisite for students to undertake e-learning course. Thus, complete knowledge of the system and front end technology is a basic requirement for undertaking e-learning but further than that it does not play a significant role in effectiveness of e-learning.

7.4.3   Student-content interactivity

This research confirms that student-content interactivity is an important factor influencing effectiveness of e-learning. In terms of content the manner in which content is organised as well as the ease with which learners can access this content is a vital aspect in improving

effectiveness of e-learning. The role of teacher is quite critical in this respect because he/she assists in enhancing the perceived level of student-content interactivity.

7.4.4 Student-teacher interaction

Apart from student-student interaction, student-teacher interaction was found to be second most influential factor affecting effectiveness of e-learning. The role of teacher in e-learning is quite critical because teacher is responsible not only for delivering the course content but also deliver it in a manner which ensures that the learners simultaneously acquire independent learning and knowledge construction skills. In order to achieve this the teachers must also be trained in delivering e-courses. This research finds that the lack of knowledge of using e-learning among some of the Saudi higher education institution professors lead them to use it conservatively as a medium of delivering content. However this research finds that teachers should act proactively in this regard ad must look to develop independent learners. They can achieve several strategies for this including developing content which promotes independent and collaborative working.

7.5   Key recommendations

In context of e-learning Reeves and Hedberg (2003) recommended that evaluation should involve evaluating the achievement of both short and long term goals. One of the problems with past research has been the short term approach whereby the researchers have mainly focused on identifying the course related benefits of e-learning i.e. investigating whether e-learning provides the same level o subject knowledge as classroom learning. This research goes a step further from this restricted mindset and assumes that the potential of e-learning is far reaching and much more useful as compared to the subject related knowledge. It has the capability of turning us into a knowledge based society where the individuals never stop learning.

In terms of gaining of knowledge the effectiveness of e-learning is viewed from the constructivism perspective. Constructivists believe that knowledge is nothing but sense making of our experiences and environment. Thus, knowledge is as we construct it. Researcher believes that looking at learning from constructivist viewpoint is logical in context of e-learning because e-learning allows the learner to learn independently. In e-learning anyone can be the instructor and hence a formal teacher-student relationship may not exist. In this respect e-learning has the potential of transforming the individuals into independent learners. If taught properly e-learning can provide individuals with skills that they can use to continue learning even when they are out of the formal education system. This is quite critical because in today's technologically rapidly developing society continuous upgrade of skills is required. Individuals who are not able to upgrade their skills from time to time are either left behind or are inefficient in performing their tasks. E-learning skills provide all the individuals equal access and opportunity to develop their skills without the need of formal support. In this manner e-learning can do a great deal of service to the overall upliftment of the human society. This has also become possible with the rising penetration of internet and internet enabled devices in human society.

In order to achieve this it is essential that e-learning programs are designed and implemented properly. One of the things that the researcher finds is required is to widen the focus of e-learning from beyond subject specific skills to independent learning skills. Research finds that adequately designed programs which promote independent learning provide far more benefits as compared to subject specific programs. In this regard this research finds the role of teachers and content developers to be critical. Teachers must look to focus on developing independent learning skills and must choose the method of teaching which promotes this. By allowing students to independently identify areas of interest, search content, analyse and present it the teachers can empower the student to self learn which will be very beneficial for them in developing effective independent learning skills. Content developers need to design the content so as to facilitate independent learning. Thus, instead of structuring they should look into increasing interactivity. The benefit of structuredness is that the student learns about the subject but with interactivity student is able to develop his/her learning abilities. Given the amount of information available online and given the variety of tools available to access this information it seems a wiser approach to look into developing skills which the student, can then use to develop his/her knowledge.

In addition to these this research makes the following recommendations

- The increased usage of internet in personal and professional fields has made it easy for individuals to interact. Not only has it improved it on the technological side making it easy to interact but also on the skills side as the individuals are now more adapt to communicating in short sentences.   Consequently efforts must be drawn to make use of these technology in e-learning to improve interaction. For example, whatsap messages are far quicker form of communication than a formal email. It would be interesting to explore use of such messaging systems in e-learning systems. What the e-learning systems planners must see is that making use of informal methods of communication and information exchange in e-learning systems because these are the methods that individuals use for the rest of their lives. By using informal methods, the process of skills learning could seep into our informal lives and thought process which will be very beneficial for the human society as a whole

- Teachers can improve effectiveness of e-learning by providing constructive and prompt feedback to the students. In this respect the teachers should look to develop a more feedback oriented course design which allows the students to obtain regular feedbacks. This means, that instead of one end of the year assessment, having several incremental assessment over the duration of the course may be more helpful.

- Interaction between teacher and learner should be driven by the student. This does not mean that the teacher should not reach out to the students but that the teacher must motivate the student for asking question. Asking questions is an important ingredient in the development of constructivist skills. Also to much communication from the teacher could lead to dependency on the teacher which could inhibit development of constructivist learning.

- This research finds that one of the reasons why e-learning has not reached its full potential is the lack of knowledge of use of e-learning among the higher education institution professor especially in the developing nations such as Saudi Arabia. This lack of expertise in using e-learning leads these professors into using e-learning systems quite

conservatively , that is, to deliver the content only. In order to overcome this, it is recommended that the professors teaching e-learning courses should be provided special training so as to develop their e-learning skills.

- In order to improve learner-learner interaction, teachers can look to increase group tasks in the course design. This will help the students learn about interacting with geographically dispersed individuals with a common purpose. This will be quite useful in developing independent learning skills along with other key skills such as team working.

- Content designers should look to focus on increasing student-student interaction by developing collaborative content, that is, content which requires student to student collaboration. Also the content should be designed so as to promote independent learning. For example, increase in the number of reflective exercises as well as activities which require students to explore independently and construct knowledge.

- In distance courses where students are not familiar with each other, the onus is on the instructor to motivate them to interact with each other. This could be done by organising several small group activities at the beginning of the e-learning course. This will help the students familiarise with each other and would learn to cooperate with each other. This is likely to benefit them for the rest of their life.

- Role of language in internalizing the external information cannot be ignored as individuals often tend to be more receptive to the knowledge conveyed in their language of choice. In this respect individuals often have two sets of languages, one hat they use for formal communication such as at workplace and second is the one that they use for personal/' informal communication such as with friends. Our minds process the information depending on what kind of language it has been spoken in – if our mind recognises it as formal language, it would treat it as professional communication but if the mind considers the language as informal it is very likely to process the information as personal communication. This is relevant in case of e-learning because teachers must understand which tone to communicate with the students in. It can only be achieved if the teachers interact with students so as to be able to understand their minds and identify the

best kind of language to communicate with. It can be argued that the teachers in e-learning courses require better communication skills than the teachers in classroom courses because of the limited use of important communication methods such as body language an eye contact. All this has to be made up by verbal and audio communication and it requires special skills for the teachers to be able to interact as effectively with individuals who are not in front of them.

7.6   Limitations

This study has some limitations and addressing these limitations can guide to interesting opportunities for further research. Firstly, this research looked at interactivity aspects only from the perspective of the students. It would have been interesting to include the perspective of the teachers into how interactivity can be improved in e-learning. As this research finds, teachers are at the centre of providing interactive online courses and they may have some valuable suggestions regarding how interactivity can be improved in e-courses.

This research included questionnaire survey and focus group data from both current and former e-learners but majority of the sample comprised of current e-learners. Students who may have not yet experienced e-learning could also provide some interesting insights into why e-learning effectiveness is different from that of classroom learning. A bit more diversified sample in this regard could have been useful. However, there were several limitations in accessing a wider sample especially regarding the permission from the institutions. Despite this shortcoming the researcher believes that the findings of this research is quite accurate given that all of the respondents who have responded to the survey had experience of using e-learning and have the now how to comment on the effectiveness and interactivity in e-learning.

This research did not investigate the perspective of the service providers as in the technical limitations on providing more interactive online courses. It would have been useful to include their perspective to understand how they organize the courses in order to minimize the gap between online and classroom courses.

Sample bias is a concern in this research because data was collected from four Saudi higher educational institutions only with 83 percent of the respondents coming from two of those institutions. This could have led to some degree of bias because there could be difference in the level of interactivity in different types of courses in different institutions. Furthermore, data was not categorized according to the institutions and hence divergence, if any, in findings from the three institutions was not investigated. This was so because the researcher had no detailed information to reflect on the difference in the findings from the three institutions.

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Questionnaire Sample

Accessibility
- Do you believe in your capability to deal with e-learning?

Definitely	Yes	Cannot say	No	Not at all
☐	☐	☐	☐	☐

- Are you willing to participate in e-learning activities?

Definitely	Yes	Cannot say	No	Not at all
☐	☐	☐	☐	☐

- Are you satisfied with the time flexibility of e-learning system?

Definitely	Yes	Cannot say	No	Not at all
☐	☐	☐	☐	☐

- Are you satisfied with place flexibility of e-learning system?

Definitely	Yes	Cannot say	No	Not at all
☐	☐	☐	☐	☐

- Are you satisfied with the access to information provided by e-learning?

Definitely	Yes	Cannot say	No	Not at all
☐	☐	☐	☐	☐

- Are you satisfied with the quality of display in your e-learning system?

Definitely	Yes	Cannot say	No	Not at all
☐	☐	☐	☐	☐

- Is your e-learning system clear and easy to use?

Definitely	Yes	Cannot say	No	Not at all
☐	☐	☐	☐	☐

- Is your IT infrastructure reliable and secure?

Definitely	Yes	Cannot say	No	Not at all
☐	☐	☐	☐	☐

- Is the screen layout and design in your e-learning system appropriate?

Definitely	Yes	Cannot say	No	Not at all
☐	☐	☐	☐	☐

- Are you satisfied with the way in which content is organised in your e-learning system?

Definitely   Yes   Cannot say   No   Not at all
☐   ☐   ☐   ☐   ☐

- Do you find problems in navigating through your e-learning system?

Definitely   Yes   Cannot say   No   Not at all
☐   ☐   ☐   ☐   ☐

- Do you think that your e-learning system provides you complete information?

Definitely   Yes   Cannot say   No   Not at all
☐   ☐   ☐   ☐   ☐

- Does your e-learning system work as expected?

Definitely   Yes   Cannot say   No   Not at all
☐   ☐   ☐   ☐   ☐

- Can you rely on your e-learning system to satisfy all your information needs?

Definitely   Yes   Cannot say   No   Not at all
☐   ☐   ☐   ☐   ☐

- Do you trust the information provided by your e-learning system?

Definitely   Yes   Cannot say   No   Not at all
☐   ☐   ☐   ☐   ☐

-learning utilisation:

- Do you use –learning regularly?

Definitely   Yes   Cannot say   No   Not at all
☐   ☐   ☐   ☐   ☐

- Do you use e-learning for all your information needs?

Definitely   Yes   Cannot say   No   Not at all
☐   ☐   ☐   ☐   ☐

- Are you likely to use e-learning for your future information and knowledge needs?

Definitely   Yes   Cannot say   No   Not at all

☐   ☐   ☐   ☐   ☐

- Have you explored online for information beyond your curriculum?

Definitely   Yes   Cannot say   No   Not at all

☐   ☐   ☐   ☐   ☐

- Are you likely to motivate your friends to adopt e-learning?

Definitely   Yes   Cannot say   No   Not at all

☐   ☐   ☐   ☐   ☐

- Do you find it exciting to use e-learning?

Definitely   Yes   Cannot say   No   Not at all

☐   ☐   ☐   ☐   ☐

- Have you joined any online forums or online communities after e-learning?

Definitely   Yes   Cannot say   No   Not at all

☐   ☐   ☐   ☐   ☐

E-learning outcomes:

- Have you gained the knowledge that you wanted to gain from e-learning?

Definitely   Yes   Cannot say   No   Not at all

☐   ☐   ☐   ☐   ☐

- Are you likely to become a contributor to online knowledge community i.e. through online forums and blogs?

Definitely   Yes   Cannot say   No   Not at all

☐   ☐   ☐   ☐   ☐

- Have you used other e-services (such as e-banking) as a result of your experience with e-learning?

Definitely ☐   Yes ☐   Cannot say ☐   No ☐   Not at all ☐

- I am a better team worker as a result of E-learning?

Definitely ☐   Yes ☐   Cannot say ☐   No ☐   Not at all ☐

- Do you think you can learn without much assistance in future?

Definitely ☐   Yes ☐   Cannot say ☐   No ☐   Not at all ☐

Interactivity

Student-Teacher

- Are you satisfied with your teacher's participation in e-learning sessions?

Definitely ☐   Yes ☐   Cannot say ☐   No ☐   Not at all ☐

- Do you think that your teacher provided individualised consideration for your e-learning needs?

Definitely ☐   Yes ☐   Cannot say ☐   No ☐   Not at all ☐

- Do you think that your teacher supported independent learning?

Definitely ☐   Yes ☐   Cannot say ☐   No ☐   Not at all ☐

- Do you think that you and your teacher know each other well?

Definitely ☐   Yes ☐   Cannot say ☐   No ☐   Not at all ☐

- Did you teacher promote team working in e-learning?

Definitely ☐   Yes ☐   Cannot say ☐   No ☐   Not at all ☐

- Did your teacher provide you sufficient support and guidance to use e-learning?

Definitely   Yes   Cannot say   No   Not at all
☐   ☐   ☐   ☐   ☐

- Did your teacher provided structured learning?

Definitely   Yes   Cannot say   No   Not at all
☐   ☐   ☐   ☐   ☐

- Did your teacher engaged you in discussions?

Definitely   Yes   Cannot say   No   Not at all
☐   ☐   ☐   ☐   ☐

Student-content

- Did you find the content suitable to your requirements?

Definitely   Yes   Cannot say   No   Not at all
☐   ☐   ☐   ☐   ☐

- Did you find the e-learning content easily accessible?

Definitely   Yes   Cannot say   No   Not at all
☐   ☐   ☐   ☐   ☐

- Did you feel that the content could be customised to your needs?

Definitely   Yes   Cannot say   No   Not at all
☐   ☐   ☐   ☐   ☐

- Did you find the e-learning content complete?

Definitely   Yes   Cannot say   No   Not at all
☐   ☐   ☐   ☐   ☐

- Was the content structured and organised adequately?

Definitely   Yes   Cannot say   No   Not at all
☐   ☐   ☐   ☐   ☐

Student-System

- Did the system perform as expected?

Definitely   Yes   Cannot say   No   Not at all

☐   ☐   ☐   ☐   ☐

- Did you find the system easy to use?

Definitely   Yes   Cannot say   No   Not at all

☐   ☐   ☐   ☐   ☐

- Do you know how to find help when you get stuck in e-learning?

Definitely   Yes   Cannot say   No   Not at all

☐   ☐   ☐   ☐   ☐

- Did you find the e-learning system pleasant to use?

Definitely   Yes   Cannot say   No   Not at all

☐   ☐   ☐   ☐   ☐

- Do you think that the content in your e-learning system was laid out adequately?

Definitely   Yes   Cannot say   No   Not at all

☐   ☐   ☐   ☐   ☐

- Would you like to use a similar e-learning system again?

Definitely   Yes   Cannot say   No   Not at all

☐   ☐   ☐   ☐   ☐

Student-Student

- Did the system allow you to develop rapport with the other group members?

Definitely   Yes   Cannot say   No   Not at all

☐   ☐   ☐   ☐   ☐

- Do you think that you knew your group members well?

Definitely   Yes   Cannot say   No   Not at all

☐   ☐   ☐   ☐   ☐

- Did you feel as part of a learning group as you would in a class?

Definitely   Yes   Cannot say   No   Not at all

☐   ☐   ☐   ☐   ☐

- Could you work with other members of the group as a team?

Definitely   Yes   Cannot say   No   Not at all
☐   ☐   ☐   ☐   ☐

- Could you ask other group members if you needed any help?

Definitely   Yes   Cannot say   No   Not at all
☐   ☐   ☐   ☐   ☐

- Did the e-learning system make you feel part of a team?

Definitely   Yes   Cannot say   No   Not at all
☐   ☐   ☐   ☐   ☐

- Did you post messages for other group members?

Definitely   Yes   Cannot say   No   Not at all
☐   ☐   ☐   ☐   ☐

- Are you an active member of your college's social network?

Definitely   Yes   Cannot say   No   Not at all
☐   ☐   ☐   ☐   ☐

Focus Group Sample

Can you tell me your opinion on what is meant by effectiveness of e-learning?

What do you mean by interactivity in e-learning?

How do you think the interaction between the teacher and the student affect the overall effectiveness of e-learning from student's perspective?

- Do you think they should interact more?
- What would you think is high quality interaction?
- Do you think it is quite important for teachers to interact directly with each and every student or only when required?

Do you think interactive content can affect effectiveness of e-learning?

- What do you mean by interactive content?
- Do you think interactive content can help learners learn independently?
- Do you think interactive content can motivate e-learners learn independently?
- How do you think interactive content be developed?

Do you think student-system interactivity can affect effectiveness of e-learning?

- What do you think is an interactive system?
- Do you think interactive system can help e-learners learn independently?
- Do you think interactive system can motivate e-learners learn independently?

What role do you think student to student interaction play in e-learning?

- How can student to student interaction be promoted in e-learning?
- Do you think interacting with peers affect students ability to learn independently?
- How do you think peer interaction motivate e-learners learn independently?
- Does peer interaction help e-learners learn better?

What do you think is more important in e-learning outcomes- learn about the subject being taught or the development of the e-learning skills?

What do you think is the role of the teacher in e-learning?