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*Video Conferencing Technology for Distance Learning  
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Communication System based on Internet and wifi  
Technology for Communication Enhancement*

ABEER DHAFER ALGARNI

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**Video Conferencing Technology for Distance Learning in Saudi Arabia: Current Problems, Feasible Solutions and Developing an Innovative Interactive Communication System based on Internet and wifi Technology for Communication Enhancement**

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**School of Engineering and Computing Sciences**

**Durham University**

**Doctor of Philosophy  
2014**

## Abstract

*Context: In Saudi Arabia, distance-learning plays a vital role in the female higher education system. This system is considered unique among all the world's countries because, for religious reasons, intermixing of the genders is not allowed within most educational settings in Saudi society. This system is currently facing a problem with an overflow of female students in higher educational institutions as these institutions suffer from a lack of female faculty members. To resolve this problem, all universities in Saudi Arabia utilise synchronous distance learning technologies such as video and audio conferences technologies for the delivery of subjects by male faculty members to female students, as this is the only authorised way for male faculty to teach female students. Although this method has been used in Saudi Arabia continuously since 1970, no study has addressed the perceptions of female students, regarding the problems they face whilst studying, through such technologies or proposed any solution for these problems.*

*Aim: The purpose of this study is to identify the perceptions of female students at King Saud University regarding the difficulties and barriers they encounter in the distance learning classrooms that use video conferencing technology. This study also proposes feasible solutions for the most common problems. It has developed an innovative interactive communication system, CommEasy, based on the internet and Wi-Fi technologies for handheld devices and uses this system to enhance communication and participation in distance learning.*

*Method: The research questions are answered by applying a mixture of quantitative and qualitative approaches that have been selected according to the nature of the research. A case study research design was chosen to address all the research questions related to KSU. Identifying the perceptions of female students about the problems they encounter in distance learning classrooms was gathered through a questionnaire with five main parts: classroom physical design, classroom physical features, technical support, communication and participation with male instructors and classroom management. Each part used a number of questions to measure the students' perceptions and the students were asked to respond to each question using a five-point Likert scale. Proposing feasible solutions for the problems reported by students required using a mixture of methods, such as observations, structured interviews and surveys. An incremental software development approach was used to develop the CommEasy tool that was used in this thesis and the quasi-experimental method was used to evaluate this tool in the actual learning environment.*

*Results: The results of the thesis presented the perceptions of students towards the components of the distance-learning classrooms and showed all the satisfactory and unsatisfactory components. It produced a list of strategies for effective designing of the distance-learning classroom that uses video conference technology, produced a new physical design for the distance-learning classrooms that used video conference technologies, provided a set of feasible solutions for the problems identified and finally, showed that the CommEasy system has a positive impact, in supporting communication in the distance-learning classroom, leading to an increased level of student participation with instructors, as well as solving most of the problems students were faced with in this regard.*

*Conclusions: in summary, the outcome of this thesis should provide both researchers and decision makers with an insight into the problems facing students in distance-learning, as well as providing them with feasible solutions for these problems. This thesis will serve as a basis for further research in this field to be conducted in Saudi Arabia.*

## Glossary of Terms Used

Distance Education	“Institution-based, formal education where the learning group is separated, and where interactive telecommunications systems are used to connect learners, resources, and instructors ” (Schlosser and Simonson, 2009, p.1).
Distance Education Delivery Methods	“Those that permit any education received by the student to occur when the teacher and the student are separated by location and/or time” (Lindner and Murphy, 2001, p.37).
Personal Response System (PRS)	PRS is “an electronic system consisting of a software package running on the instructor’s computer, a small, handheld, wireless device (a clicker) used by students to transmit their responses to questions posed by the instructor and a small receiver to pick up signals from students’ clickers” (Wright, 2009,p.2).
Interactive Whiteboard (IWB).	“A touch sensitive screen that works in conjunction with a computer and a projector” (SMART Technologies, 2004).
Classroom Space	“The square footage within the walls including the seating area, the circulation space, any instructor/demonstration area, and storage/service area associated with the room” (ASU Design Guidelines, 2011, p.4).
Classroom Design Guidelines	“Overarching principles to create functional, flexible and aesthetically pleasing classrooms” (ASU Design Guidelines, 2013, p.21).
Sharia	“A composite of religious rites and legal duties derived from the Holy Qur’an along with examples from the life of the Prophet Muhammad (PBUH), known as the Sunnah” (Sfeir, 1988,p.730).
Intisab	“A system which allows individuals to pursue higher education without attending lecture” (AlRawaf and Simmons, 1992, p.65).

# Contents Overview

<b>Abstract.....</b>	<b>ii</b>
<b>Glossary of Terms Used.....</b>	<b>iii</b>
<b>Contents Overview.....</b>	<b>iv</b>
<b>List of Abbreviations.....</b>	<b>ix</b>
<b>Copyright.....</b>	<b>x</b>
<b>Declaration.....</b>	<b>xi</b>
<b>Acknowledgement.....</b>	<b>xii</b>
<b>Chapter 1: Introduction.....</b>	<b>1</b>
1.1 The Essential Components of the Distance-Learning Environment....	2
1.2 Research Questions....	4
1.3 Limitations of the Research....	5
1.4 Criteria for Success....	6
1.5 Thesis Outline....	7
1.6 Summary....	8
<b>Chapter 2: Literature Review.....</b>	<b>9</b>
2.1 Distance Education....	9
2.1.1 Definition of Distance Education....	9
2.1.2 History of Distance Education....	11
2.1.3 Distance Education Delivery Methods....	13
2.1.4 Advantages and Disadvantages of Distance Education for Learners....	14
2.1.5 Advantages and Disadvantages of Synchronous and Asynchronous Distance Education....	15
2.1.6 Effective of Technologies on Teaching-Learning.....	17
2.2 Distance Learning Barriers....	18
2.2.1 Distance Learning Barriers- General Overviews.....	18
2.3 Technologies Enhance Communication and Participation...	21
2.3.1 Importance of Communication in the Classroom....	22
2.3.2 Personal Response System (PRS)....	23
2.3.2.1 Advantages and Disadvantages of the PRS...	24
2.3.2.2 Effectiveness of PRS on the Interaction in the Classroom...	25
2.3.2.3 Obstacles to using PRSs in the Classroom...	27
2.3.2.4 PRS to Support Communication in the Distance Learning Classroom....	27

2.3.3	Interactive Whiteboard (IWB)....	28
2.3.3.1	Advantages and Disadvantages of the IWB ...	28
2.3.3.2	The IWB to Support Communication and Interaction in the Classroom...	29
2.3.4	Twitter.....	30
2.3.4.1	Advantages and Disadvantages of the Twitter...	30
2.3.4.2	The Twitter to Support Communication and Interaction in the Classroom.....	30
2.4	Summary.....	31

**Chapter 3: Research Method and Design.....33**

3.1	Overview of the Research Method and Design.....	33
3.2	Methodology to Address the RQ1 (The Pilot Study + the SLR).....	37
3.3	Methodology to Address RQ2, RQ3 and RQ4 (Case Study Research Design (KSU))....	41
3.3.1	Method for Answering RQ3: The Survey for Identifying the Perceptions of Female Students at KSU Regarding the Problems They Faced in Distance-Learning Classrooms in KSU ...	43
3.3.2	Method for Answering RQ4: Instruments Employed for Proposing Solutions for KSU Problems....	53
3.3.2.1	The Role of Students' Preparation in Reducing Discipline Problems in Distance-Learning Classrooms in Saudi Arabia...	54
3.3.2.2	The Role of the Teaching Assistants in Synchronous Distance-Learning Classrooms in KSU.....	55
3.4	Methodology to Address RQ5 (The Incremental Approach for Software Development)....	56
3.5	Methodology to Address RQ6 (The Quasi-Experimental Method for Evaluation of the CommEasy System....	56
3.5.1	The Comparative Analysis.....	57
3.5.2	User Questionnaire.....	58
3.5.2.1	The Students' Questionnaire...	58
3.5.2.2	The Instructors Questionnaire....	59
3.6	Summary.....	60

**Chapter 4: Case Study of Women's Education in Saudi Arabia..... 61**

4.1	Saudi Arabia.....	61
4.1.1	Saudi Arabia Geographical and Cultural Context...	61

4.1.2	Overview of Education in Saudi Arabia...	62
4.1.3	Overview of Higher Education in Saudi Arabia.....	63
4.1.4	The Higher Education of Females in Saudi Arabia...	64
4.1.5	Background of Gender Division in Saudi Arabia.....	66
4.1.6	Historical Background of Distance Education in Saudi Arabia....	66
4.1.7	The Importance of Distance Education in Saudi Arabia...	67
4.1.8	Saudi's Universities Efforts in Distance Education....	68
4.2	Distance-Learning Environment in KSU.....	69
4.2.1	Distance-Learning Environment in KSU.....	69
4.2.2	Arrangement of Classroom Equipment.....	71
4.2.3	Physical Features of the Classroom.....	72
4.3	Summary.....	75

## **Chapter 5: Classroom Design.....76**

5.1	Classroom Physical Design....	76
5.1.1	Learning-Room Types....	77
5.1.2	Definition of Classroom Design....	81
5.1.3	Importance of Classroom Design.....	82
5.1.4	Arrangement of Classroom Equipment.....	83
5.2	Classroom Physical Features.....	93
5.2.1	Location of the Learning-Room...	94
5.2.2	Size of the Learning-Room...	95
5.2.3	Shape of the Learning-Room...	95
5.2.4	Door(s) of the Learning-Room....	97
5.2.5	Ceiling of the Learning-Room....	100
5.2.6	Floor of the Learning-Room..	101
5.2.7	Walls of the Learning-Room...	102
5.2.8	Coulor/Finishes in the Learning-Room...	103
5.2.9	Windows in the Learning-Room...	103
5.2.10	Student's Desks and Chairs in the Classroom.....	105
5.2.11	Aisles in the Learning-Room...	108
5.2.12	Lighting of the Learning-Room...	109
5.2.13	Temperature, Ventilation and Air Conditioner.....	111
5.2.14	Level of Noise and Acoustics in the Learning-Room...	111
5.2.15	Cleanness of the Learning-Room...	118
5.3	Technical Support in Distance-Learning Classroom....	119
5.4	Classroom Management.....	122
5.4.1	Definitions of Classroom Management...	123
5.4.2	Classroom Management in the Synchronous Distance Learning Classrooms....	123

5.4.3 Strategies for Managing Discipline Problems in the Synchronous Distance-Learning Classrooms.....123

5.5 Summary.....129

**Chapter 6: CommEasy: an Innovative Interactive Communication System .....131**

6.1 Motivation and Pedagogical Considerations....131

6.2 Requirement Determination and Analysis.....133

6.3 Developing the System.....134

6.4 Testing and Evaluation.....141

6.5 Summary.....142

**Chapter 7: Results and Findings.....143**

7.1 Procedures of Data Analysis.....144

7.1.1 Distribution of Data...144

7.1.2 The Kolmogorov-Smirnov Test (K-S)...145

7.1.3 The Paired t-Test....145

7.2 Results of the Pilot Study.....146

7.2.1 Data Validation...144

7.2.2 Reliability and Validity of Data...146

7.2.3 Procedures of the Data Analysis...146

7.2.4 Data Coding....147

7.2.5 Distribution of the Data...147

7.2.6 Results of the Pilot Study.....148

7.3 Results of the Main Questionnaire Identifying the Perceptions of Female Students in KSU Regarding the Problems They Faced in Distance-Learning Classrooms in KSU....152

7.3.1 Data Validation...152

7.3.2 Reliability and Validity of Data...153

7.3.3 Data Coding....153

7.3.4 Analysis Framework....153

7.3.5 Findings of the Study...157

7.4 Results of the Students' Preparation Survey....163

7.4.1 Data Validation...164

7.4.2 Reliability and Validity of the Data...164

7.4.3 Results of Students' Preparation Questionnaire...164

7.5 Results of the Teaching Assistant Study.....167

7.5.1 Reliability and Validity...167

7.5.2 Results of the Teaching Assistant Study...167

7.6 Results of the CommEasy System Evaluation....	169
7.6.1 Reliability and Validity.....	169
7.6.2 Results of the Evaluation of the CommEasy System...	169
7.6.2.1 The Comparative Analysis...	170
7.6.2.2 The Results of the Survey...	173
7.7 Summary....	175
<b>Chapter 8: Discussion.....</b>	<b>176</b>
8.1 Classroom Equipment Arrangements.....	176
8.1.1 Microphones in the Classroom...	176
8.1.2 Screens in the Classroom.....	178
8.1.3 Loudspeakers in the Classroom....	180
8.2 Classroom Physical Features....	180
8.3 New Classroom Physical Design...	186
8.4 Technical Support in the Classroom....	187
8.5 Classroom Management and Communication with Male Instructors....	192
8.6 Summary....	195
<b>Chapter 9: Conclusion .....</b>	<b>196</b>
9.1 Thesis Overview.....	196
9.2 Criteria for Success and Contributions of the Thesis...	196
9.3 Limitation of the Research...	198
9.4 Future Work....	199
9.5 Summary....	199
<b>Appendix and References .....</b>	<b>200</b>

## **List of Abbreviations**

AEC: Acoustic Echo Cancellers.

DSP: Digital Signal Processing.

GPGC: The General Presidency of Girls Colleges.

GCADE: The Girl's Colleges Agency for Distance Education.

HVAC: Heating, Ventilation and Air Conditioner.

IQR: Interquartile Range.

ITU: International Telecommunication Union.

KAFSP: King Abdullah's Foreign Scholarship Program.

KAU: King Abdulaziz University.

KAULMS: King Abdulaziz University Learning Management System.

KSU: King Saud University.

MOHE: Ministry of Higher Education.

NRC: Noise Reducing Coefficient.

PNU: Princess Nora Bent Abdulrahman University.

RT: Reverberation Time.

SLR: Systematic Literature Review.

Str: Strategy For the Effective Designing of the Distance-Learning Classrooms.

SN: Signal to Noise Ratio

SSDE: The Saudi Society for Distance Education.

STC: Sound Transmission Class.

UNDP: United Nations Development Programme.

VSAT: Very Small Aperture Terminal.

## **Copyright**

The copyright of this thesis rests with the author. No quotation from this thesis should be published without prior written consent. Information derived from this thesis should also be acknowledged.

## Declaration

No part of the material provided has previously been submitted by the author for a higher degree in the Durham University or in any other University. All the work presented here is the sole work of the author and no-one else. The following publications were produced during the course of this thesis:

- Algarni, A., and Burd, L., "A study on the barriers facing female students who are studying with male instructors through synchronous distance learning technologies in Saudi Arabia", *In Proceeding of the 5<sup>th</sup> Saudi Scientific International Conference*, Coventry, United Kingdom, 2011.
- Algarni, A., and Burd, L., "An Exploratory Study of Female Students' Attitudes to Video and Audio Conference Technologies in Saudi Arabia", *In Proceeding of the 6<sup>th</sup> Saudi Scientific International Conference*, London, United Kingdom, 2012.
- Algarni, A., and Burd, L., "The role of the teaching assistant in synchronous distance learning classrooms in Saudi Arabia", *In Proceeding of the 6<sup>th</sup> Saudi Scientific International Conference*, London, United Kingdom, 2012.
- Algarni, A., and Burd, L., "The importance of student preparation in reducing discipline problems in distance learning classrooms in Saudi Arabia", *In Proceeding of the 6<sup>th</sup> Saudi Scientific International Conference*, London, United Kingdom, 2012.
- Algarni, A., and Burd, L., "CommEasy: An Innovative Interactive Communication System for Promoting Communication and Participation ", *Paper will be submitted to FIE Conferences 2015*.
- Algarni, A., and Burd, L., "Perceptions of Students and Instructors toward the Role of CommEasy in tackling Communication and Interaction Barriers in Distance-Learning Classrooms", *Paper will be submitted to FIE Conferences 2015*.

## Achievements

The following achievements were obtained during the course of this thesis:

In the final ceremony of the 5th International Saudi Conference, that was held in Coventry in the United Kingdom from 23-26 June 2011, the researcher was awarded with a certificate of excellent achievement for her participation in the conference and her achievements.

In September 2012, a personal invitation was received from the Royal Embassy of Saudi Arabia to attend the largest ceremony conducted in the presence of the Saudi Ambassador, HRH Princess Nawaf ben Abdulaziz AlSaud, to honour excellent Saudi students in the United Kingdom. The researcher was one of 49 Saudi students chosen for their achievements and their excellence during their studies from all Saudi students in the United Kingdom. The researcher was awarded with a certificate of excellence from the Ambassador.

In December 2013, the researcher was awarded a certificate of excellence from the Princess Nora bent Abdulrahman University (PNU) for her achievements during her PhD study in the UK. PNU is the university where the researcher employed.

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# 1 Introduction

With the continuous advancement in information and communication technologies, distance-learning has become an essential part of many educational systems all over the world. In Saudi Arabia, distance-learning plays an essential role in the females' higher education system. This system is considered unique among all the world's countries because, for religious reasons, intermixing of genders is not allowed within most educational settings in Saudi society. This system is facing a problem with an overflow of female students in higher educational institutions that are suffering from a shortage of qualified female instructors (Nakshabandi, 1993; Nakshabandi and Alageeli, 1997; Elerini, 1999; Alsemairi, 2007; Sendi, 2008; Allily, 2011). To solve such a problem, all universities in Saudi Arabia are utilising various synchronous distance-learning technologies such as Closed-circuit Television (CCTV), audio conferencing technology and video conferencing technology for the delivery of subjects by male faculty members to female students, as this is the only authorised way for male instructors to teach female students.

In such distance-learning models, the problems facing female students should be considered by both researchers and decision makers in Saudi universities, and feasible solutions for these problems should be provided. These problems are related to various important components of the distance-learning environment such as the physical design of the classroom, the physical features of the classroom, technical support, classroom management and finally communication and participation with male instructors. Many educators worldwide have reported the importance of these components in the teaching-learning process and have asserted that all problems related to these components should be considered and attempts should be made to solve them.

Therefore, the aim of this research will be to identify the perceptions of female students in the College of Computer and Information Sciences at King Saud University (KSU) with regard to the problems they face in the distance-learning classrooms that using video conferencing technology, and to propose feasible solutions for the most common problems that emerge. This research will also take into consideration the huge advancement in technologies enhanced learning in recent years and the positive impact of such technologies on teaching-learning process in all its dimensions especially in enhancing communication and participation between students and instructors, and will design, implement and evaluate an

innovative interactive communication system (CommEasy) for smart handheld devices based on internet and wifi technologies. This system will be used for enhancing female students' communication and participation with male instructors in the distance-learning classroom, and solve some of the problems students face in this regard. The following section will briefly discuss the five main components of the distance-learning classroom that will be considered in this research.

### **1.1 The Essential Components of the Distance-Learning Environment**

As mentioned previously, this research will consider and evaluate five main components of the distance-learning classrooms in KSU, and will identify the problems facing female students in terms of each of these components and will propose feasible solutions accordingly. The importance of such components in the teaching-learning process has been asserted by many educators, as will be discussed briefly in this section.

It has been reported that the well-designed classroom brings numerous advantages to students and enhances the teaching/learning process. These include encouraging student participation, increasing students desire to learn and improve their learning experience. According to Hawkins (1997) good classroom design improves learning. Earthman (2013) has asserted that the classroom should be designed and arranged in a way that enhances students learning and experience. Clabaugh (2004, p.1) stated that:

“Students have a fundamental right to a classroom learning environment that allows them to see anything presented visually, to hear any audible presentation free from other noises and distortions, and to be physically comfortable (lighting, temperature, furniture, etc.) regardless of the method of instruction”

Researchers have confirmed that designing a classroom for distance-learning requires careful planning, preparation, organisation and any barriers facing students and instructors should be considered and eliminated.

In addition to the physical design of the classroom, many researchers have asserted that the physical features of a classroom, such as lighting, ventilation, temperature, etc., are very important to the overall educational climate and have an effect on student learning (Brown and Lippincott, 2003; Winterbottom and Wilkins, 2009; Hill and Epps, 2010; Harvey and Kenyon, 2013). Harvey and Kenyon (2013) assert that the physical features of a university

classroom have a large impact on the teaching/learning process. These features may also affect other components of the learning environment such as interactions within the classroom. In distance-learning classrooms, students and instructors should be able to see and hear each other and be comfortable communicating with each other. Aspects of the classroom environment such as noise, either internal or external, may affect this communication and hinder the teaching/learning process.

The physical design of the classroom and the physical features are not the only components that should be considered in improving the learning environment. In addition, providing appropriate technical support for both students and instructors is a crucial component for creating a successful and effective distance-learning environment. Many researchers have reported that technical issues and equipment failures are of major concern for both instructors and students in both traditional and distance-learning settings. If appropriate technical support is not offered, many problems can arise, such as feelings of frustration and anxiety on the part of both instructors and students. Therefore, providing technical support via professional technical assistants and providing effective channels for communication with them; is an essential component of a successful distance-learning environment.

Classroom management is another essential component that will be considered in this research. It has been reported to be a primary concern of instructors of all levels of experience in traditional education (Emmer and Hickman, 1991; Martin and Sass, 2010; Kafle, 2013). Martin and Sass (2010, p.1) reported that this issue is:

“A powerful element of the overall classroom climate as it impacts the level of student engagement, the frequency of inappropriate behaviour, and, by extension, the quality of student learning”

In both distance-learning and traditional settings, researchers have reported that “effective teaching and learning cannot take place in a poorly managed classroom” (p.6) (Marzano and Marzano, 2003).

The last important component that will be considered in this research is related to communication and interaction in the classroom. The communication and interaction between students and instructors in the classroom is the cornerstone of learning (İşman, 2003; Powell and Powell, 2010). Through effective ways of communication between students and instructors, many things can change: learning can become easier, the module objectives are more likely to be achieved, the instructor and students tend to have a better relationship and a

better atmosphere can be created for both the instructors and students. In the distance-learning classrooms, communication and interaction has also been regarded as a pivotal element in building a successful learning environment (İşman, 2003). Therefore, supporting communication and interaction in the classroom, removing communication barriers, and applying new educational technologies and applications can lead to the creation of a more effective and successful learning environment. Many researchers have reported that the use of mobile applications in an educational environment has received lots of attention in recent years, and such applications will not only help bridge the gap between the way students live and the way they learn, but will also create a more enriching learning experience for them and solve many problems. The development and use of such applications has been discussed by many educators worldwide and has been supported by strong pedagogies (McConatha et al., 2008; Hwang and Chang, 2011; Wankel and Blessinger, 2013).

Despite the importance of the above-mentioned components, no study has yet determined the problems female students faced in this regard in KSU, or has proposed feasible solutions for these problems. As reported by many educators and facility planners, identifying the perceptions of students with regard to such components is an essential aspect of improving the teaching/learning process and should be given high priority (Alsemairi, 2007; Al-Aboudi, 2008; Sendi, 2008; Allily, 2011). However, a major part of the development and usage of distance learning technologies has been propelled by technological advancements with little regard for the perceptions and views of end users. Indeed, some institutions spend a large amount of their scarce funds in adding new technologies to the classroom; however, they mostly have ignored human factor and users opinions in such an improvements (Thurnquist, 2009).

## **1.2 Research Questions**

Until now, no study has identified female students' perceptions towards the problems they encounter in the distance-learning classrooms that use video-conferencing technology in KSU (See Chapter 4.2), nor have any studies proposed solutions for these problems. Thus, the purpose of this research is to address this issue by determining the perceptions of female students toward the barriers facing them in distance-learning classrooms with male instructors in KSU, and then propose solutions that could be applied to solve these problems. The study will also develop an innovative interactive communication system (CommEasy) that will be used to enhance communication and interaction between male instructors and

female students, and solve the problems female students face in this regard. The importance of conducting this research has been affirmed by many educators in higher education institutions in Saudi Arabia (Alsumari, 2007; Sendi, 2008; Al-Aboudi, 2008; Allily, 2011). This study was conducted in order to address the following six main questions:

RQ1: What are the problems that face female students in the distance-learning classrooms in Saudi Universities?

RQ2: What are the strategies that should be followed for the effective design of distance-learning classrooms that use video-conferencing technology in KSU?

RQ3: What are the perceptions of female students in the College of Computer and Information Sciences in KSU towards the problems they encounter in distance-learning classrooms that use video-conferencing technology?

RQ4: What are the feasible solutions for the current problems reported by female students in distance-learning classrooms that use video-conferencing technology in KSU?

RQ5: What is the better method to create an innovative interactive communication system (CommEasy) for participation enhancement in the classroom?

RQ6: What is the impact of using CommEasy on the participation level of female students with male instructors in distance-learning classrooms in KSU?

For questions 1 to 5, no hypotheses are to be tested. For question 6, the following hypothesis will be tested:

$H_1$ : Female students' participation with male instructors in distance-learning classrooms will be increased using the CommEasy system, compared with not using CommEasy.

### **1.3 Limitations of the Research**

It has been recognised that this study may be limited by the situations described in the following points:

- This study focuses on the perception of female students at KSU toward the distance-learning model described in Chapter 4.2, others means of delivering distance-learning such as audio conferencing, desk-top video conferences etc. were not examined in this study.

- Neither the transmission medium such as fiber optic, microwave signal etc., nor the components of the male instructor's studios will be evaluated in this study. However, brief discussion for these topics will be considered in the study.
- This study is survey-based research and uses a questionnaire to gather the required information; the use of a questionnaire limited this study by the deficiency associated with the questionnaire method of research such as the respondent's honesty.
- The provided version of the CommEasy system will support only an iOS platform. Other mobile platforms such as Android cannot be supported in this version due to time restrictions.
- The provided version of the CommEasy system can be used only on smart handheld devices and not desktop computers.
- The provided version of the CommEasy system can support iOS 5.0.1 to iOS 7.0.4 which is the latest version released by Apple prior to the submission of this research.

#### **1.4 Criteria for Success**

The fundamental factor that will be used to determine the success of the research is the provision of satisfactory answers to the six research questions mentioned in Section 1.2. These research questions can be classified into six main categories.

Category 1: Identification and classification of the most common problems facing female students in distance-learning classrooms in Saudi Arabia.

Category 2: Providing strategies that should be followed for the effective design of distance-learning classrooms in KSU.

Category 3: Identifying the perceptions of female students with regard to the problems they encounter in distance-learning classrooms that using video conferencing technology in KSU.

Category 4: Providing feasible solutions for the current problems reported by female students in KSU.

Category 5: Determining the requirements of developing and evaluating an innovative interactive communication system (CommEasy) that can be used to support communication and participation in distance-learning classrooms in KSU, and solve problems students face in this regard.

Category 6: Evaluating the impact of the CommEasy system in terms of enhancing female students' participation and encouraging interaction with male instructors in the distance-learning classroom.

These six categories will be addressed throughout the research as follows:

- The common problems facing female students in distance-learning classrooms will be presented in Chapter 2.
- The strategies that should be followed for effective design of the distance-learning classrooms that use video-conferencing technology will be presented in Chapter 5.
- The perceptions of female students with regard to the problems they encounter in the distance-learning classrooms that using video conferencing technology at KSU will be presented in Chapter 7.
- The feasible solutions for the problems reported by female students in KSU will be presented in Chapter 8.
- The process of designing, implementing and evaluating the innovative interactive communication system (CommEasy) will be presented in Chapter 6.
- The results of evaluating the impact of CommEasy on the level of students' participation will be presented in Chapter 7.

### **1.5 Thesis Outline**

The remainder of this thesis will be structured as follows:

Chapter 2 – Literature Review: this chapter provides an essential background for the study, such as the distance learning concept and distance learning barriers, and discusses some of the technologies that can be used to support communication and participation in the classroom.

Chapter 3 – Research Method and Design: this chapter discusses the research methods employed to answer the research questions of the study.

Chapter 4 – Case Study of Women's Education in KSU in Saudi Arabia: this chapter discusses women's education in Saudi Arabia, the efforts made by universities regarding distance-learning, and the distance-learning environment at KSU that will be evaluated in this study.

Chapter 5 – Classroom Design: this chapter discusses the main components for designing the classroom that have been considered in this research (classroom physical design, classroom physical features, technical support and classroom

management). In this chapter, a list of strategies for the effective design of distance-learning classrooms will be produced.

Chapter 6 – CommEasy system: this chapter discusses the process of designing, implementing and testing the CommEasy system that will be used to support and enhance communication and interaction in the classroom.

Chapter 7 – Results and Findings: this chapter presents the results of the study. It includes a discussion of the statistical procedures and the statistical tests applied in the analysis.

Chapter 8 – Discussion: this chapter discusses the results presented in Chapter 7 and proposes feasible solutions for the problems reported by female students at KSU.

Chapter 9 – Conclusions: this chapter provides a conclusion of all the work conducted in the thesis and provides recommendations and suggestions for further research.

## **1.6 Summary**

This chapter discussed the purpose of the research, its questions, limitations as well as criteria for success. The next chapter will focus on the literature review and will discuss many significant topics related to this research.

# 2 Literature Review

This chapter provides a basic background of the study and a review of the related literature.

This includes:

Distance Education: This section provides a basic understanding of the distance education concept, its history, and the advantages and limitations of synchronous and asynchronous distance education.

Distance Education Barriers: This section lists the most common barriers to distance learning and summarises the work of other researchers regarding these barriers.

Technologies Enhance Communication and Participation: This section discusses the role of modern technology in supporting communication and participation in the classroom. It also discusses the details of Personal Response Systems (PRSs) and provides examples of technologies that can be used to support communication and interactions in the classroom, such as Interactive Whiteboard and Twitter.

The next chapter will discuss the methodology of the research.

## 2.1 Distance Education

This section covers key concepts regarding distance education. The discussion includes its definition, a history of distance education, distance education delivery methods, advantages and disadvantages of synchronous distance education, advantages and disadvantages of asynchronous distance education and distance education technologies.

### 2.1.1 Definition of Distance Education

The term ‘Distance Education’ first showed up in the catalogue of the University of Wisconsin in 1892 (Rumble, 1986). It is also made its mark in Germany by the German educator Otto Peters in the 1960's and 1970's (Verduin and Clark, 1991; Gibson and Gibson, 1995). This concept gained recognition in other European countries in the early 1990's, and according to McIsaac and Gunawardena (1996), the global community was beginning to take note of distance education.

There are many definitions as well as many terms for distance education, such as ‘distance learning’, ‘distributed learning’, ‘remote education’, ‘Web-based learning’ and ‘e-learning’

which all refer to similar education deliverables (Danenberg and Chen, 2005). Willis (1993, p.1) states:

“At its most basic level, distance education takes place when a teacher and student(s) are separated by physical distance, and technology (i.e., voice, video, data, and print), often in concert with face-to-face communication, is used to bridge the instructional gap”

Schlosser and Simonson (2009, p.1) have defined distance education as:

“Institution-based, formal education where the learning group is separated, and where interactive telecommunications systems are used to connect learners, resources, and instructors”

However, one of the comprehensive definitions for distance education have mentioned by Moore and Kearsley (1996, p.2) as:

“Planned learning that normally occurs in a different place from teaching and as a result requires special techniques of course design, special instructional techniques, special methods of communication by electronic and other technology, as well as special organizational and administrative arrangements”

For the purpose of this study distance education will be defined according to the following criteria:

- The male instructor and female students are separated by distance (this distance means two different locations on two campuses where the distance between them is 19 kilometres). The instruction is delivered via one-way-video, two-way-audio where students can see and hear instructors but instructors cannot see female students.
- The communication is interactive in that the student receives immediate support and feedback from the instructors.

Although the concept of distance education is more than a century old, the idea has recently experienced growth and changes and new ways of looking at distance education have been developed.

### 2.1.2 History of Distance Education

Distance education is rapidly gaining recognition globally and is now considered to be one of the fastest growing fields all over the world (Schlosser and Simonson, 2009). However, the roots of this concept are at least 160 years old (Brown and Brown, 1994).

According to Moore and Kearsley (1996) the first form of distance education was correspondence education. Matthews (1999), states that distance education courses were organized in Great Britain in 1840 by the English inventor of shorthand, Sir Isaac Pitman who made use of distance education in that he used to send shorthand instructions to his students by post. Later, two important technological developments – the introduction of universal postal services and the invention of printing – allowed distance education to develop and reach individuals in their homes or place of works. These technologies are offering print-based correspondence courses (Daniel, 1996). Among the first courses were a course in Germany (Holmberg, 1986; Hanson et al., 1997; Farnsworth and Bevis, 2007; Simonson et al., 2012) and another course in the United States (Verma, 2005; Schlosser and Simonson, 2009) Teachers-students communication took place through printed materials via regular post (Schlosser and Simonson, 2009).

Since 1878, many correspondence institutions founded, such as Skerry's College in Edinburgh in 1878 and University Correspondence College in London in 1887 (Holmberg, 1986; Hanson et al., 1997; Schlosser and Simonson, 2009). In the 1900s, correspondence education continued to develop all over the world and academic degrees, including Bachelors, Masters and Doctorates, were provided through this mode (Schlosser and Simonson, 2009). In the twentieth century, correspondence education continued to rise and develop, e.g., various educational institutions in many countries such as Australia, New Zealand and Canada, introduced correspondence education for children who could not join a school for certain reasons (Schlosser and Simonson, 2009).

In addition to correspondence education, many other technologies have played a pivotal role in the development of distance education (Jones and Knezek, 1995). One of these technologies was the radio which was first used in 1920 with 176 radio stations constructed at educational institutions in the USA (Schlosser and Simonson, 2009). After that, other universities worldwide have used radio technology in distance education (Moore and Kearsley, 1996). However, it has been reported that distance education through radio technology was not a success and never became popular (Nasseh, 1997).

After the notable failure of radio technology in distance education, new technology took its place in 1930: the television (Abramson, 2003). Using the television in distance education began in 1934 in the USA in courses offered by the State University of Iowa, Purdue University and Kansas University (Gibson, 1977).

In the 1960s, the emergence of satellite technology enabled the rapid spread of instructional television (Hanson et al., 1997; Simonson et al., 2012). In 1970, the establishment of the Open University was a breakthrough in distance education made by Britain which had a major role in the development of the most important research in distance education (Zigerell, 1984).

The new millennium has significantly brought about rapid growth and development in the field of education by improving technology and ultimately, Distance Education. Internet and telecommunications technologies help to provide web-based instruction courses where the learning environment can be managed via learning management systems and learners can easily contribute in online activities and to communicate with instructors as well as other students. However, High-speed Internet (Internet 2) is probably one of the important contributions made to the field of education and universities (Burns, 2001). The emergence of high-speed Internet was the catalyst behind the introduction of many virtual universities around the world (Moore, 2003).

The history of distance education can be organised into four generations, where each generation is located in a specific time period and characterised by certain technology that dominated the generation.

- The first generation was from the 1850s to the first half of the 1960s, and this generation was characterised mostly by the use of print materials (Baath, 1980; Baath, 1985; Garrison, 1985; Holmberg, 1995).
- The second generation was from the 1960s to 1985, and this generation used new media in addition to print materials. This new media included radio, television, recorded audiotapes and telephone conferencing (Bates, 1984a; Bates, 1984b; Garrison, 1985; Boyle, 1995).
- The third generation was from 1985 to 1995. This generation was characterised by the internet and the development of new and fast technologies for delivering distance education such as computer conferences and electronic mail (Dede, 1996; Khan, 1997; Jafari, 1997, Kubala, 1998).

- The fourth generation was from 1995 to the present day, and to the foreseeable future, and this generation is characterised by enormous growth in distance education technologies, such as the internet and mobile technologies (Attewell, 2005; Motlik, 2008; Guri-Rosenblit, 2009)

In summary, there are many types of technologies used in the generations of distance education, beginning with print materials and progressing to the most recent technologies, such as mobile technologies (Anderson and Simpson, 2012).

### 2.1.3 Distance Education Delivery Methods

Distance education delivery methods defined by Lindner and Murphy (2001) as “those that permit any education received by the student to occur when the teacher and the student are separated by location and/or time” (p.37). Distance education is classified according to the delivery methods as synchronous and asynchronous. In synchronous distance education, instructors and students communicate simultaneously, where all activities, discussion, presentation and feedback occur in the same time (Hrastinski, 2008; Simonson et al., 2012). On the other hand, asynchronous distance education refers to non-simultaneous communication between instructors and students, where instructors provide materials, lectures and assignments that can be accessed by students at any time.

Synchronous distance education has many advantages such as reducing the feeling of isolation for learners and avoiding frustration with the ability to ask and answer questions in the same time (Hrastinski, 2008). It also enhances collaborative and social learning (Schullo et al., 2005; Wang, 2008). On the other hand, asynchronous distance education has more flexibility than synchronous distance education through allowing learners to learn at their own convenience and thus accommodating work and personal life (Romiszowski and Mason, 2004).

In both methods, four main categories of media are used to bridge the distance between instructor and student: audio; video; computer-mediated communication; and print (Bates, 2005). Each of these categories has several subdivisions. It is worth noting that many technologies used in distance education overlap into more than one category. Examples of technologies used in each category are shown in the Figure 2.1.

<b>Print</b>	<b>Voice/Audio</b>
Textbooks Study guides Workbooks Fax	Radio Telephone Voicemail Audioconferences Audio files/CDs Podcasts
<b>Computer</b>	<b>Video</b>
E-mail, chat, etc. Web-based resources Videoconferences CD-ROM Smartphones	Videotape Satellite delivery Broadcast video DVD

Figure 2.1: Distance Education Technologies

Each of these technologies has its own advantages and disadvantages and choosing among these technologies depends mainly on the objectives and requirements of the distance education course. According to Haefner (2000), the key points in the success of a distance course is in “knowing when to use the right tool at the right time for the right purposes” (p.1). It is beyond the scope of this study to discuss all these technologies in detail but technologies used in Saudi Arabia will be discussed in more details later in this thesis.

#### 2.1.4 Advantages and Disadvantages of Distance Education for Learners

For the learners, researchers have reported many advantages and disadvantages in the use of distance education (Cowan, 1995; Purnell et al., 1996; Bartolic-Zlomislic and Bates, 1999; Strambi and Bouvet, 2003; Gottwald, 2005). Some advantages can be summarised as follows:

- **Convenience**: distance education provides learners with a convenient environment for learning, e.g., some programs are easily accessible from home or work.
- **Flexibility**: in many forms of distance education, learners can participate in a preferred time for them and on an individualised basis, e.g., some students prefer the middle of the night to work, while others may prefer early morning.
- **Effectiveness**: many studies report that distance education is equally or sometimes more effective than traditional education, especially when there is timely teacher-to-student interaction (Moore and Thompson, 1990; Verduin and Clark, 1991).
- **Accessibility**: distance education is characterised by its accessibility to many learners; for example, learners who face geographical difficulties such as living in rural areas or learners who face physical barriers such as disabilities.

- **Multi-Sensory**: in most distance education programs, a wide variety of materials that meet learners' needs can be used, e.g., some learners prefer visual stimuli, such as video, while others prefer listening or interacting with a computer applications.
- **Time saving**: some distance education programs help to save learners time, e.g., travel time.
- **Computer Proficiency**: distance education programs mostly require use of computers and this helps learners to gain high computer proficiency.
- **Teamwork**: as distance education connects learners from all over the world, it helps to develop cooperation and collaborative learning amongst learners and allows learners to develop strong networks.

However, researchers have also reported the common disadvantages of distance education for learners, which can be summarised as the following:

- **Isolation**: the feeling of isolation is one of the challenges faced by learners in distance education and reported by many researchers.
- **Frustration**: sometimes lack of communication, especially in asynchronous distance education, may lead to a feeling of frustration for learners.
- **Technology Failure**: technologies could face problems and this affects the learners and their learning process.
- **Autonomy**: some learners feel they need the teachers' presence to motivate them to do work.

Distance education, like any concept, has its advantages and disadvantages. However, it is an important alternative to conventional education and provides an enormous number of learners all over the world with an opportunity to pursue their education in order to achieve their own learning objectives.

#### 2.1.5 Advantages and Disadvantages of Synchronous and Asynchronous Distance Education

There are many advantages and disadvantages of synchronous and asynchronous distance education. Many researchers have compared these two delivery modes of distance education and reported the advantages and disadvantages of each method (Collis, 1996; Haefner, 2000; Ashley, 2003; Corbeil, 2006; Park and Bonk, 2007). The most significant advantages and disadvantages of synchronous and asynchronous distance education can be summarised as the following:

Advantages of synchronous distance education:

- Builds a larger sense of community by enabling real-time collaboration and social interaction between participants (Bonk and Zhang, 2006; Er et al., 2009).
- Reduces the feeling of frustration by enabling immediate response and feedback (Diaz and Entonado, 2009).
- Provide flexibility and offer students personalized learning opportunities.
- Restores some of the spontaneity that occurs in a conventional classroom environment.
- Enables body language and tone of voice.

Disadvantages of synchronous distance education:

- Sometimes different time zones may create scheduling problems for participants.
- Lack of reflection between collaborators.
- Failures in technology could interrupt the session or delay it.
- Needs time commitment from participants.
- Some technologies, e.g., video and audio conferencing need special specifications such as high bandwidth.
- The cost of some technologies could be high.

Advantages of asynchronous distance education:

- More flexible; learners are able to join a class at anytime and/or anyplace.
- The ability for learners to correspond, regardless of time zone.
- Allows opportunity for reflection.
- Can incorporate a variety of technologies.

Disadvantages of asynchronous distance education:

- No immediate feedback.
- Lack of collaboration and social interaction.
- May lead to feelings of isolation and frustration for participants.
- The technology needed may sometimes be costly.

Both synchronous and asynchronous distance education have their own advantages and disadvantages and choosing between them depends on the requirements and objectives of the distance education program. However, this study is concerned with synchronous distance education technologies.

### 2.1.6 Effectiveness of Technologies on Teaching-Learning

Recently, there has been an important growth in the availability of ICT, with the potential to support and improve teaching-learning quality in institutions of higher education (Lai, 2011). However, the impact of these technologies on education, teaching and learning has become a field of consideration for many researchers. In the last two decades, numerous studies have been conducted for the purpose of the evaluation of the overall effect of ICT on the teaching-learning process in higher education (Collis and Van Der Wende, 2002; Yelland et al., 2008; Balasubramanian et al., 2009; Bates, 2010).

Laurillard (2006) has reported that these technologies have been used effectively in enhancing traditional forms of teaching-learning and with regard to administration in institutions of higher education. Bates (2010) also confirms this and reports that these technologies help to enhance current teaching practices and "...being add on to the traditional classroom experience" (p.23). It is also believed that these technologies minimise the differences between the conventional ways of education and distance education due to the promise of 'individualised' and 'collaborative' learning (McIsaac and Gunawardena, 1996; Laurillard, 2006). It has also been reported that such technologies promote communication and interaction in the classrooms, motivate students to participate, and make the learning environment happier and livelier (Liu et al., 2003; Hall et al., 2005).

However, it has been reported that the outcome of using such technologies in supporting teaching-learning in higher education is below expectations, and a gap is existed between what is said and what is done in the use of these technologies (Guri-Rosenblit, 2005; Schaffert, 2010). Rossiter (2007) argued that pedagogical practices are seldom affected deeply by the current revolution in these technologies and that there has been little shift in the focus of control of learning from the teacher to the learner. Balasubramanian et al. (2009,p.19-20) reported that while:

"There is a trend to introduce eLearning or online learning both in courses taught on campus and in distance learning... it is too early to say whether the role of ICTs in the teaching function of higher education is truly transformative, or whether it is simply a repackaging of previous pedagogy"

Veletsianos (2010, p.4) adds that:

“While expectations have run high about instructional radio, television, personal computers, the internet, web 2.0, e-learning, m-learning, the latest technological innovations of our times, results have often been disappointing”

Ehlers and Schneckenberg (2010) also support this point of view, and argue that the integration of e-learning in institutions of higher education has been disappointing because the use of these technologies has not coincided with any important pedagogical changes.

Despite these different opinions regarding the impact of technologies on education, teaching and learning, it is important to note that all of these technologies are just vehicles to deliver information and instruction to students, and that what is really important is how educators combine the characteristics of these technologies with innovative teaching methods to give students an unforgettable experience (Heinich et al., 2001). It is also difficult to evaluate and judge how these technologies impact on teaching-learning process because there are simply numerous kinds of such technologies and tools, and it is hard to keep pace with all of these. It is necessary to evaluate the impact of individual technologies through conducting systematic and longitudinal studies (Lai, 2011). To sum up, the importance of these technologies in the field of education should not be ignored, as these have eliminated the time and place barriers that exist for both the student and the teacher. However, example of such technologies will be discussed in more detail later in the thesis.

## **2.2 Distance Education Barriers**

To create an effective distance-learning environment, it is essential to overcome the barriers both instructors and students face in this environment. This topic has attracted researchers worldwide who seek to identify the barriers and look for possible solutions. This section provides a basic background of the most common barriers. The barriers that will be considered in this study, such as the classrooms’ physical design and classroom management, etc., will be discussed in more details later in this thesis.

### **2.2.1 Distance-Learning Barriers- General Overviews**

According to Galusha (1997) distance education barriers can be classified into three main categories in the form of student, faculty and organizational barriers. Dabaj (2011) has classified distance education barriers in a similar manner, as being barriers from the students, instructors and an administrative point of view. The main focus of this study is on the problems or barriers from the students’ point of view. Forty-one studies regarding distance

education barriers have been analysed in this research (they have been underlined in the references, See References). The result of the analysis of these studies has led to the following categories of problems or barriers encountered by students in distance education:

- **Lack of Face-to-Face Communication**: although distance education provides students with more flexibility in learning, and allows them more convenience when it comes to choosing time, place and kind of study, on the other hand the lack of face-to-face contact with an instructor, and the lack of communication with an instructor after class may result in a loss of motivation for students (Galusha, 1997; Muilenburg and Berge, 2005; Dabaj, 2011).
- **Resistance to Change and Anxiety**: Dabaj (2011) states that students and instructors can have psychological problems when involved in distance education classes due to a resistance to change and to anxiety.
- **Lack of Experience in Using Technologies**: Perreault et al. (2002) mentioned that students can experience some technical barriers while being involved in distance education due to a lack of experience in using the technology. In addition, sometimes the failure of equipment and the absence of appropriate technical assistance can increase the problem and may cause students to feel frustrated.
- **Lack of Student Preparation and Training**: Galusha (1997) mentioned that in the distance-learning, students mostly will find themselves playing a different role than is the norm in traditional education. Consequently, students should be prepared for this and be aware of such a changed role. It is preferable that students should be provided with appropriate support when they join in distance-learning courses and during all its stages.
- **Lack of Social Interaction**: Croft et al. (2010) state that the separation of students and instructors and of students themselves in time or place or both, and the lack of immediate interaction and collaboration, can lead to feelings of isolation and alienation, and may cause frustration for some students.
- **Lack of Instructor Support and Immediate Feedback**: Leach and Walker (2000) argue that the immediate feedback from instructors to students in distance education is vital for students' self-evaluation, task orientation and flexibility. Lack of support or lack of immediate feedback from the instructor can cause some problems for students and may hinder their learning process.

- **Fear of Technology**: Muilenburg and Berge (2005) argue that fear of using new technologies and a lack of software skills or unfamiliarity with some learning tools could be a barrier that causes students to abandon a distance-learning course, or may lead at the very least to frustration.
- **Late Arrival of Course Materials**: Muilenburg and Berge (2005) argue that the late arrival of course material and the lack of sufficient academic advisors from institutions are considered one of the barriers facing distance learners.
- **Lack of Non-verbal Cues such as Gestures**: non-verbal cues such as gestures are a central feature of face-to-face communication. It has been reported that the lack of non-verbal cues in the distance-learning environment may cause learners to feel uncertain in their communication and to feel isolated (Muilenburg and Berge, 2005).
- **Lack of Time and Support**: sometimes a lack of time or a lack of support provided for the students from family, friends, etc. is considered a barrier for students in their distance education course (Muilenburg and Berge, 2005). In addition to this, when students enroll in a distance education course from different locations, time zone differences may be a barrier for students and can affect their learning e.g. their level of participation (Cifuentes and Shih, 2001).
- **Lack of Personal and Cultural Information About Peers**: sometimes, students lack personal and cultural information about their peers in a distance-learning environment. As students from different cultures interact, multicultural differences might arise as the norms for one culture might cause offense to individuals from another culture. Also, because students lack personal information about each other, they cannot relate to each other as they would in a normal classroom. This leads to inaccurate assumptions about fellow students.
- **Self-discipline Problems**: the separation of instructor and students in the distance education, and the lack of ability of instructors to observe student behaviour may lead to discipline problems. Furthermore, in the global context, an unfamiliarity with the disciplinary culture in the institution may also lead to discipline problems (Zhao and McDougall, 2008).
- **Economic Barriers**: the cost of a distance education course is one of the primary concerns for distance learners. This includes many aspects in online learning such as tuition fees, technology costs such as those associated with computers, modems, and associated software, and even the cost of internet service providers (Galusha, 1997).

- **Classroom Climate and Layout**: Clabaugh (2004, p.1) stated that:

“Students have a fundamental right to a classroom learning environment that allows them to see anything presented visually, to hear any audible presentation free from other noises and distortions, and to be physically comfortable (lighting, temperature, furniture, etc.) regardless of the method of instruction”

All of these issues should be considered in designing distance-learning classrooms and the absence of one of these elements may lead to problems for students and for instructors.

However, as Dabaj (2011) stated, despite attempts to classify distance-learning barriers, all the above-mentioned categories overlap considerably and merge together. In this study, distance-learning barriers have been classified into five main categories that include: classroom physical design, classroom physical feature, technical support, classroom management and communication and participation with instructors. These categories will be discussed in detail in Chapter 5.

### **2.3 Technologies Enhance Communication and Participation**

Nowadays, the extensive advancements in Internet and ICT, especially mobile communication devices, have greatly affected ways of communication and receiving information (Subrahmanyam et al., 2008). These advancements have changed many aspects of people’s lives in many fields. In education, for example, Ogan et al. (2008) stated that education today involves a large number of students who have used these technologies and are comfortable with them. Kingsley (2007) has suggested that these technologies should be adopted in higher education to support the teaching-learning process. However, adopting these technologies in the classroom requires many changes in the traditional teaching practices and especially needs instructors to change their formal teaching techniques (Papo, 2001). The effectiveness of using these technologies in the classroom has been confirmed by many studies. Many researchers have indicated that using these technologies can support students’ learning and can encourage students to be more active and engaged learners (Draper and Brown, 2004).

These technologies can also support students' participation and communication with instructors in both traditional learning and distance-learning. The example of these technologies that will be considered in detail in the present study is the Personal Response System (PRS), which is one of the most up-to-date technologies that can be used for this purpose. Furthermore, some other technologies will also be mentioned briefly in this section such as whiteboard and Twitter.

### 2.3.1 Importance of Communication and Interaction in Classroom

The communication process in the classroom is the cornerstone of learning and plays an important role in the transfer of knowledge from the instructor to the students (Isman et al., 2003). Through effective ways of communication between students and instructors, many things can change: learning can become easier, the module objectives are more likely to be achieved, the instructor and students tend to have a better relationship and a better atmosphere can be created for both the instructors and students (Boyle and Nicol, 2003). However, the major role in such communication is play by the instructor. The interaction in the classroom depends largely on the ways the instructor uses in teaching and communication with students (Rubin and Feezel, 1986; Rubin and Morreale, 1996). Instructors should try to reduce the communication gap in the classroom through, for example, encouraging classroom discussion or small group works (Powell and Powell, 2010). In addition to that, the responsibility of the instructor does not end with the delivery of information to the students. Instructors are expected to be good and attentive listeners also, since communications works both ways (Powell and Powell, 2010). By being sensitive to the students and to their needs, the effective classroom instructor will be able of adapt the contents to the students and the situation (Simonds and Cooper, 2011). Furthermore, the instructor needs to be able to use language that is simultaneously understandable and attractive to a variety of audiences. In this way the instructor encourages comprehension and maintains interest in the classroom (Simonds and Cooper, 2011). For successful classroom communication, instructors are also encouraged to provide regular feedback to their students and show enthusiasm for their topics in order to make the class more interesting (Powell and Powell, 2010). Furthermore, It is reported that one of the values of instructor-student communication is facilitating the instructor-student relationship (Gorham, 1988). This relationship is a key factor in making teaching and learning more effective and satisfying (DeVito, 1986). In addition to verbal communication, non-verbal aspects such as facial expression and gestures also play a great

role in the teaching-learning process. In general, an instructor's communication methods have been seen to influence how students feel about the learning process as well as their satisfaction and achievement in the classroom (Kerssen-Griep, 2001; Cole et al., 1999).

In distance-learning, Communication has been also regarded as a pivotal element in building a successful environment (Isman et al., 2003). Unlike in traditional education where communication between students and instructors takes place face-to face, in distance-learning, communication between students and instructors takes place through the use of technology, including asynchronous and synchronous communication technologies. In a synchronous distance-learning environment, effective communication is also considered the key to meaningful and enjoyable learning (Gibson, 1998; Gibson and Herrera, 1999; Motteram, 2001). This communication should also be free of any barriers that might hinder the communication process (Nasseh, 1997; Dabaj, 2011). In addition, such communication can be supported and strengthened by adopting new methods of teaching as well as adopting new technologies.

Nowadays, communication between students and instructors has been affected by the continuous growth of the technologies and tools that play an important role within the field of education in general and in distance-learning specifically. Many technologies have been developed in order to increase interactivity and support communication between students and instructors in the classroom. Examples of technologies that can be used to support communication and interaction in the distance-learning classroom are the Personal Response System (PRS), Interactive Whiteboard (IWB) and Twitter. These technologies will be discussed in the next sections.

### 2.3.2 PRSs

A PRS is a technology consisting of a combination of hardware and software that allows students to answer an instructor's questions in the classroom without speaking or raising their hands. By using this technology, all students can answer the same question at the same time. The PRS is a communication system that enables the instructor to collect large amounts of data from their students and to analyse these data in order to investigate whether or not learning has taken place. According to Guthrie and Carlin (2004, p.1):

“PRS ... allows large group of students to individually engage instructional content real time in the classroom and get instant feedback about their individual responses as well as seeing how the class responded as a whole”

These systems are known by many names, including electronic voting systems, classroom performance systems, electronic response systems, classroom communication systems, student response systems, audience response systems or clickers (Draper et al., 2002; Judson and Sawada, 2002; Beatty, 2004; Kay and LeSage, 2009). Despite all these names, all systems work in a similar manner. With this type of system, each student is given a handheld electronic device that allows the student to send a signal to the instructor’s computer in the classroom. Once the instructor gives a question to the students, the students can answer the question by clicking the appropriate button on their devices. The instructor’s computer receives the answers, which then shows them on a screen in front of the students. The size of the students’ devices and how many buttons are on them differs according to the manufacturer, but as already mentioned, all of them work in a similar manner (Duncan, 2005; Banks, 2006; Bruff, 2009).

#### 2.3.2.1 Advantages and Disadvantages of the PRS

**Advantages of PRS:** the PRS is gaining in popularity in higher education across the globe. It is considered as one of the best modern systems in the teaching field. It has innumerable advantages, which will be summarised here. Among these advantages, its effectiveness in the teaching-learning context and in supporting student interaction and communication will be discussed in more detail in the next section.

The use of a PRS can add an effective level of interaction and participation in the classroom (Dufresne et al., 1996; D’Inverno et al., 2003; Boyle and Nicol, 2003; Freeman and Blayney, 2005; Trees and Jackson, 2007) and can support collaboration in the classroom (Crouch and Mazur, 2001).

Furthermore, PRS allows the instructor to engage interactively with a large number of students at the same time, monitor student attendance, give quizzes during lectures and enhance the student's learning experience. These new electronic systems also minimise the dependence upon paper work. Thus, the fatigue that originates through the paper work labour can be dramatically reduced (Caldwell, 2007).

According to D’Arcy et al. (2007), PRSs support and help students to think more deeply and defend their decisions. It can be used also to encourage proactivity from shy and deprived

students. Many researchers have also reported that using PRSs in the classroom contributes to making the classroom a happier and livelier environment (Dufresne et al., 1996; Abrahamson, 1999; Elliott, 2003).

**Disadvantages of PRS:** despite all the advantages of using PRSs, these systems also have some limitations, including the following:

- PRS are used commonly to answer multiple-choice questions rather than to provide more descriptive answers (King and Robinson, 2009).
- Students who cannot work under pressure may not prefer to use this system as in most cases they are required to provide a response in a limited time.
- Ambiguous results have been observed from different studies regarding whether PRSs can be used to increase the long-term learning level.
- Student anxiety about using new technologies can also be a problem.

#### 2.3.2.2 Effectiveness of PRS on the Interaction in the Classroom

Much research has been conducted into the use of PRSs in the classroom and on students' perspectives regarding the use of such technologies (Kennedy and Cutts, 2005; Beckert et al., 2009). Many advantages have been identified as well as limitations. The role of PRS in teacher-student communication and interaction and its effectiveness in this regard will be considered in detail in this section, as it is one of the topics included in the present research. This discussion will include the effectiveness of PRSs in a general teaching-learning context, and more specifically, its effectiveness in encouraging teacher-student interaction and communication in the classroom.

**Effectiveness of PRSs in Teaching-Learning Context:** The effectiveness of using PRS in the classroom and the impact of PRS on the interactions and communications between students and instructors have been considered by many researchers. For example, classroom use of these technologies has been confirmed to lead to better student performance in both exams and assignments (Brewer, 2004; Poirier and Feldman, 2007). In addition, many studies have indicated that these technologies will help to make students more active and involved in the learning environment (Brewer, 2004; Bergtrom, 2006; Caldwell, 2007). Furthermore, using PRS can help to support collaborative learning in the classroom (Cortez, 2004). These technologies allow the instructor to have immediate feedback from the students and this will help in monitoring their performance (Burnstein and Lederman, 2006; Bruff, 2009).

**Effectiveness of PRSs in Teacher-Student Interaction:** The importance of student-teacher communication and interaction in the classroom has documented by many researchers (D'Inverno et al., 2003; Draper and Brown, 2004; Knight and Wood, 2005). The use of PRS to support communication and interaction in the classroom has also been frequently considered. Many studies have reported that these types of systems can play an important role in student-teacher interactions in the classroom:

- According to Dailey (2012), one of the main goals of using PRSs in the classroom is to increase interaction and participation.
- Many researchers indicate that students are more likely to participate during class using a PRS than one using the typical lecture format and the students also tend to stay more on task (Stowell and Nelson, 2007; Caldwell, 2007; Kenwright, 2009; King and Robinson, 2009).
- Many researchers indicate that PRS may give students who typically do not respond to questions in class a way to participate that is more comfortable to them (Beckert et al., 2009).
- Many researchers indicate that the use of PRSs in the classroom enhances communication between students and instructors and allows instructor to assess students' comprehension (Barrett et al., 2005).
- According to Caldwell (2007), for students who are shy or easily embarrassed, PRS is very useful as it offers students anonymity.
- Murphy and Smark (2006) mentioned that using PRS has a positive effect on the quieter and shy students where instructors often fail to develop meaningful contact with them.
- Draper and Brown (2004) stated that students who used PRSs have reported many positive attributes such as being able to check their understanding and encouraging participation.
- Hall et al. (2005) also indicated that using PRSs makes courses more engaging and motivational and increases students' learning.
- Beekes (2006) also reported that using PRSs helps to increase the level of student engagements and participation during lectures.
- According to Beatty (2004), the use of the PRS supports communication and interaction in the classroom and allows a large classroom to function like a small one.

- Stav et al. (2010) confirmed that PRSs have been used for many years and have been successful in increasing the level of student participation, involvement and learning.
- Many researchers have recommended that the use of PRS can cause students to become more emotionally vested in their responses and to pay more attention to class discussions (Wit, 2003; Beatty, 2006).

#### 2.3.2.3 Obstacles to Using PRSs in the Classroom

One of the main obstacles of using PRSs in the classroom is related to instructor resistance. Many researchers have reported that instructors may sometimes have concerns regarding adopting new technologies in the classroom (Mumtaz, 2000). Therefore, successful adoption of technologies in the classroom requires that instructors receive proper encouragement as well as technical support when applying the new technologies in the classroom. In addition, the recommendation is made that instructors be provided with some kind of incentive, either monetary or scholarly, to encourage them to use new technologies in the classroom (Weston, 2005).

In addition to faculty resistance, technical issues are also important obstacle preventing the use of PRS. Examples of the technical issues that arise with PRS include availability, support, reliability, customisation, transferability, cost, set-up time and training (Dailey, 2012). Some of these technical issues can be controlled by providing appropriate training and support from the university for both students and instructors (Hartman and Truman-Davis, 2001).

#### 2.3.2.4 PRSs to Support Communication and Participation in the Distance-Learning Classroom

As mentioned previously, PRSs have been confirmed to be a successful technology for supporting communication and interaction in the classroom and to make students more engaged in the learning environment. In the distance-learning classroom, support of student-teacher communication and interaction and minimisation of barriers that might hinder this communication are key factors that are sought by many educators to improve their distance-learning classrooms. As the PRS proves its success in supporting communication and interaction in traditional classroom, this system can be also applied in the distance-learning classroom.

PRSs are undergoing tremendous advances and new types of PRSs based on the latest wireless technologies and handheld mobile devices have been developed during the past few

years that used to enhance active learning methods and support student-instructor interactions. Examples of these systems are now being reported by many researchers (Stav et al., 2010). Examples of a system that has developed in this research to enhance communication and participation in the distance-learning classroom will be given in Chapter 6. In addition, other technologies that can be used to support communication and participation in the classroom will also be discussed in the following sections.

### 2.3.3 Interactive Whiteboard (IWB)

The IWB is a revolutionary educational tool that has been used worldwide to support and enhance students' learning by providing them with a learning environment that enhances interaction and collaboration, and offers students the opportunity to learn in new ways (Betcher and Lee, 2009). The IWB is known by many names, including Smart Boards, Active Boards, Webster and Electronic Whiteboards (Northcote et al., 2010). This technology has numerous advantages, and can be used in both traditional settings as well as in distance-learning.

The IWB has been defined as a "...touch sensitive screen that works in conjunction with a computer and a projector" (SMART Technologies, 2006). When it connects to the computer, the computer's desktop is displayed on the board by a digital projector, meaning that the desktop can be seen and manipulated. Users can control the computer from either the computer itself or from the whiteboard, using pen, finger, stylus, etc. The IWB allows users to draw, write on its surface, open applications, print off images, download images and save them to the computer, or send it over the internet (Bell, 2002; Kennewell and Higgins, 2007; Roberts, 2007).

#### 2.3.3.1 Advantages and Disadvantages of the IWB

**Advantages:** the IWB can help instructors to improve the content of their presentation by enabling them to integrate a wide range of materials including video, animation, graphics, text and audio. Integrating all these materials can help to accommodate different learning styles and different types of learners such as visual learners, audio learners, etc. (Smith et al., 2005; Kelley et al., 2007). The IWB enables the creative and dynamic integration of Web-based materials and enables a quick retrieval of materials. The IWB can also enhance students' discussion in the classroom through freeing them from note taking and allow them to work collaboratively around shared tasks (Haldane, 2007). Researchers have reported also

that as a result of using the IWB in the classroom, students are better engaged, behaved and motivated (Northcote et al., 2010). The IWB is also an excellent tool for use in a distance learning setting, and allow instructors and students to interact with each other and share lots of resources (Kennewell, 2006).

**Disadvantages:** the IWB has also some disadvantages such as cost, in that it is more expensive than conventional whiteboards or projector and screen combinations. The surface of the board is easily damaged and expensive to replace (SMART Technologies, 2006). It requires specific software and specific training and assistance for instructors and students who will use it (Northcote et al., 2010).

#### 2.3.3.2 The IWB to Support Communication and Interaction in the Classroom

It has been reported that IWBs are mostly perceived by students and instructors as a positive addition to the classroom learning environment. Many studies have been conducted to investigate its impact on the teaching-learning process in all its dimensions (Beeland, 2002; Bell, 2002; Cuthell, 2005; Haldane, 2007; Northcote et al., 2010). One such dimension relates to student interaction in the classroom, and their participation and communication with instructors. Many studies have been conducted to identify the correlation between the use of an IWB in the classroom and student participation or engagement. The majority of these studies report that the use of IWBs in the classroom can affect students learning in many ways including increased student participation, motivating students to be more engaged in the classroom, and promoting an enthusiasm for learning (Northcote et al., 2010; Painter et al., 2005). The IWBs can also be used to accommodate a variety of learning styles that will enhance student understanding as well as student achievement (Swan et al., 2007).

The IWBs can also solve some of the problems that arise in other technologies such as computer-based technologies. Researchers have reported that one of major challenges facing many new technologies is to maintain a dynamic interaction with students, because they almost always concentrate on their own computer screens. Researchers argue that having a large display surface that everyone can see and interact with can encourage and increase the level of student interaction, and such a feature is provided by the IWB (Manny-Ikan and Dagan, 2011). The IWBs are not only useful in traditional classrooms; distance learning is also an excellent setting for IWB use, where they can be used to encourage student interaction with the instructors as was the case in the traditional classroom (Betcher and Lee, 2009).

#### 2.3.4 Social Media (Twitter)

Twitter is another technology that spread widely in the past few years and can be used to enhance interactions and communications between users in various settings, of which education is one. Twitter is "...an online social networking service and microblogging service that enables its users to send and read text-based messages of up to 140 characters, known as 'tweets'" (Twitter, 2013). It established in 2006 by Jack Dorsey. In 2012, the number of registered Twitter users worldwide was over 500 million, who generated over 340 million tweets daily (Twitter, 2013). .

##### 2.3.4.1 Advantages and Disadvantages of Twitter

There are numerous advantages with regard to the use of Twitter in various settings. It also has some limitations. In this section, some of the general advantages and disadvantages of Twitter will be mentioned. The next section will discuss in more detail the benefits of using Twitter in an educational setting.

**Advantages:** there are numerous advantages of Twitter including that it is free, easy to join, easy to use, and allows millions of users worldwide to interact with each other. Twitter users can follow each other to get news and updates, tweet or re-tweet, and can use their Twitter ID to login to many sites and send comments. It has also specific applications that are available for all smart phones (Twitter, 2013).

**Disadvantages:** there are also some limitations with regard to Twitter including the following: sometimes users find it difficult to express ideas, comments or questions in 140 characters. Twitter may have spamming problems and it is considered insecure by some users who are concerned about sharing their personal information with third parties, privacy issue.

##### 2.3.4.2 Twitter to Support Communication and Interaction in the Classroom

The phenomenon of social networking has grown rapidly in the past few years. The huge advancement in the mobile technologies and smart phones has contributing to the growth of these networks. More than 90% of adults worldwide use these social networks through their mobiles on a daily basis (Galagan, 2010). For Twitter, more than 190 million Twitterers tweet around 65 million times per day (Costolo, 2010). It is estimated that about 70% of adults read tweets and blogs (Galagan, 2010). The role of these networks in education has been highlighted by many educators worldwide, who have investigated the impact of using

these technologies in the classroom on students and instructors (Crook, 2008; Hughes, 2009; Grosseck and Holotescu, 2009; Ebner et al., 2010; Schroeder et al., 2010).

Twitter allows students and instructors to interact via ‘tweets’ through using their smartphones, laptops, or any device with Internet access. Twitter can help students to build a community and encourage them to interact with their peers as well as with their instructors (Java et al., 2007; Matney and Borland, 2009). Twitter can also promote pre-class discussion, where students can tweet their questions or points before the lesson, and such questions and comments can be used to generate discussion in the classroom (Luo and Gao, 2012). Through using Twitter, students can also interact with many education professionals and universities worldwide in order to ask for advice and to benefit from others’ experience. They can also distribute articles and opinions to others, and receive feedback (Luo and Gao, 2012).

Twitter is also very useful in terms of increasing engagement and participation, especially in large classes, and allows students who are shy with a convenient way to post their comments or questions (Heiberger and Harper, 2008; Junco et al., 2011). Twitter can be used also in the distance-learning setting. For example, in video conferencing classrooms, Twitter can be used to allow students to engage in real-time discussion while they watch their instructors on the screen.

For the instructors, they can use Twitter to provide immediate feedback for their students and can also create a shared hashtag for a classroom that all students can use. Hashtags are one of the most powerful tool of the microblog, and they help to keep a record of what has been taught in class, and help to keep everything together. It also makes it easy to follow important and interesting topics, or anything else that might broaden a student’s knowledge base. Twitter can also used by instructors as a Bulletin Board where they can post any news or events around the classroom.

In summary, Twitter has proven to be a powerful tool in order to increase engagement and interaction in the classroom in both traditional and distance-learning settings. Currently, many universities worldwide have added Twitter to their Blackboard or Moodle sites, and have encouraged their students and staff to use it.

## **2.4 Summary**

This chapter provided a basic background of the study and reviewed the related literature, including distance education, distance education barriers and the technologies that can be used to enhance communication and participation in the classroom. The next chapter will

discuss the study's methodology, including the study population, the sample and sampling procedures, the data collection procedures etc.

# 3 Research Method and Design

This chapter discusses the methodology of the research. The research design and methods employ to answer the research questions posed in Chapter 1 explain in details in this chapter. All the instruments built to collect data in this thesis present in this chapter, with a detailed description of the design, translation and evaluation of these instruments.

## 3.1 Overview of the Research Method and Design

According to Kothari (2009), at the start of any type of research, it is essential for the researcher to decide the most suitable research methodology to carry out the study. For most types of research, various methods can be used to address the research problem, and choosing among them should be given considerable thought by the researcher (Beiske, 2002). Determining the appropriate method(s) depends on many variables such as research questions, time, available resources, the topic being considered or the data required. However, it is essential to evaluate all the possible method(s) to choose the most suitable for achieving the research objectives (Cohen et al., 2011).

For this research, once the research questions were determined, the available literature was searched to determine the suitable and effective research methods to obtain the data required for the research and to achieve the objectives of the research successfully. It was decided to use a mixed methods approach, selected according to the nature of this research, to provide appropriate answers for all the research questions posed in chapter 1 as will be discussed later in this chapter. Using a mixed methods approach within a single study has been supported by many researchers, and there is a growing number of research and evaluation studies that make use of this method (Moore, 2000; Elliott, 2004; Bell, 2005; Walliman, 2006; Punch, 2005; Dawson, 2009). It has been reported that the use of such an approach provides many benefits: an increase in the validity of the results of the study, better data collection instruments and an increased understanding of the research results (Johnson and Onwuegbuzie, 2004). This method combines the strength of both quantitative and qualitative approaches. The qualitative approach has its own strengths as well as its own weakness and the same is true for quantitative research, but their strengths can be increased and their weaknesses can be minimised when they are combined (Johnson and Onwuegbuzie, 2004).

Connelly (2009) confirms this and stated that “the goal of mixed methods research is to draw on the strengths and minimize the weaknesses of both types of research” (p.31).

The mixed methods approach has been applied and used widely in many fields including educational and social science studies, as discussed by many researchers such as Elliott (2004), Johnson and Onwuegbuzie (2004), Creswell et al. (2011) and Cohen et al. (2011). It is also employed widely in the field of engineering, computing and information systems, as discussed by many researchers such as Mingers (2003) and Petter and Gallivan (2004).

In summary, the methods used in answering the research questions of this thesis are as follows:

**RQ1:** What are the problems that face female students in the distance-learning classrooms in Saudi Universities? To answer this question, a Systematic Literature Review (SLR) was combined with a Pilot Study.

**Objective:** The objective was to search the available literature to collect evidence about the barriers or problems faced students who are enrolled in distance-learning classrooms worldwide, and to investigate more specifically the barriers faced female students who enrolled with male instructors in distance-learning classrooms in universities in Saudi Arabia.

**Outcome:** The outcome is determining the most common problems or barriers faced students in distance-learning classrooms worldwide and more specifically in Saudi Arabia. The problems faced by female students in distance-learning classrooms in Saudi Universities were divided into five main categories: classroom physical design, classroom physical features, technical support, classroom management and finally communication and participation with male instructors.

**RQ2:** What are the strategies that should be followed for the effective design of distance-learning classrooms that use video-conferencing technology in KSU? To answer this question, a Literature Review was conducted.

**Objective:** The objective was to investigate the various problems relating to KSU’s distance-learning environment (including the physical design of the classroom, the physical features of the classroom, the technical support in the classroom and classroom management) and reviews the available literature in this regard; to produce a list of strategies that should be followed for the effective designing of the distance-learning classrooms.

**Outcome:** The outcome of the review is a list of strategies that should be followed for the effective design of the distance-learning classrooms that use video conferencing technology.

**RQ3:** What are the perceptions of female students in the College of Computer and Information Sciences in KSU towards the problems they encounter in distance-learning classrooms that use video-conferencing technology? To answer this research question, a five-part survey was designed to measure the perceptions of female students in KSU with regard to the distance-learning model used there.

**Objective:** The objectives of the survey were to determine the satisfactory and unsatisfactory aspects of distance learning classrooms that use video conferencing technology in KSU in the opinion of the students, and to determine the current problems reported by female students.

**Outcome:** The outcome is the identification of the perceptions of female students in KSU regarding all the components of the distance-learning classrooms that use video conferencing technology, and the determination of which of these are satisfactory or unsatisfactory in the opinion of the students. The results of this survey are used later to propose feasible solutions for the components that the students were dissatisfied with.

**RQ4:** What are the feasible solutions for the current problems reported by female students in distance-learning classrooms that use video-conferencing technology in KSU? To answer this research question, the list of strategies for the effective design of distance-learning classrooms that was produced earlier has been used in proposing solutions. In addition, proposing feasible solutions for some problems, such as those related to classroom management, necessitated further studies in KSU and different methods have been used for this purpose such as a survey, interviews and observations.

**Objective:** The objective of these studies was to collect data about the current efforts of the KSU and the male instructors in providing appropriate preparation for female students before they joined distance-learning classrooms and the role of such preparation in reducing discipline problems in distance-learning classrooms in KSU, to collect data about the efforts of the university in appointing female teaching assistants for male instructors and the role of those assistants in reducing discipline problems and maintaining order in the classroom.

**Outcome:** The outcome of these studies was to identify the current efforts of KSU to provide appropriate preparation for female students, to ascertain the importance of such preparation from the students' point of view, and to determine the common reasons for discipline problems in the classrooms. The results also indicated the importance of appointing female teaching assistants in distance-learning classrooms and the different roles played by those assistants in the classroom.

**RQ5:** What is the better method to create an innovative interactive communication system (CommEasy) for participation enhancement in the classroom? To answer this research question, a literature review has been combined with the incremental software development approach to develop the CommEasy system.

**Objective:** The literature review has been conducted to investigate the role of modern technologies in supporting communication and participation in the classrooms, to search the various technologies recommended by researchers in this regard and to determine the requirements for designing and implementing new technologies for this purpose. The incremental software development approach has been used to design, implement and test an innovative interactive communication system (CommEasy system) that can be used to facilitate and support communication and participation in the distance-learning classroom and solve problems experienced by students in this regards.

**Outcome:** The outcome is the production of a CommEasy System with full functionalities.

**RQ6:** What is the impact of using CommEasy on the participation level of female students with male instructors in distance-learning classrooms in KSU? To answer this research question, a quasi-experiment was conducted to evaluate the system in an actual learning environment.

**Objective:** The objective of the quasi-experiment was to evaluate the impact of the CommEasy system on female student participation with male instructors, and to test the relevant hypothesis, Female students' participation with male instructors in distance-learning classrooms will be increased using the CommEasy system, compared with not using CommEasy.

**Outcome:** The outcome is to identify the impact of CommEasy on student participation through either accepting or refuting the null hypothesis.

All the above-mentioned aspects are summarised in Figure 3.1 and will be discussed in detail in the following sections.

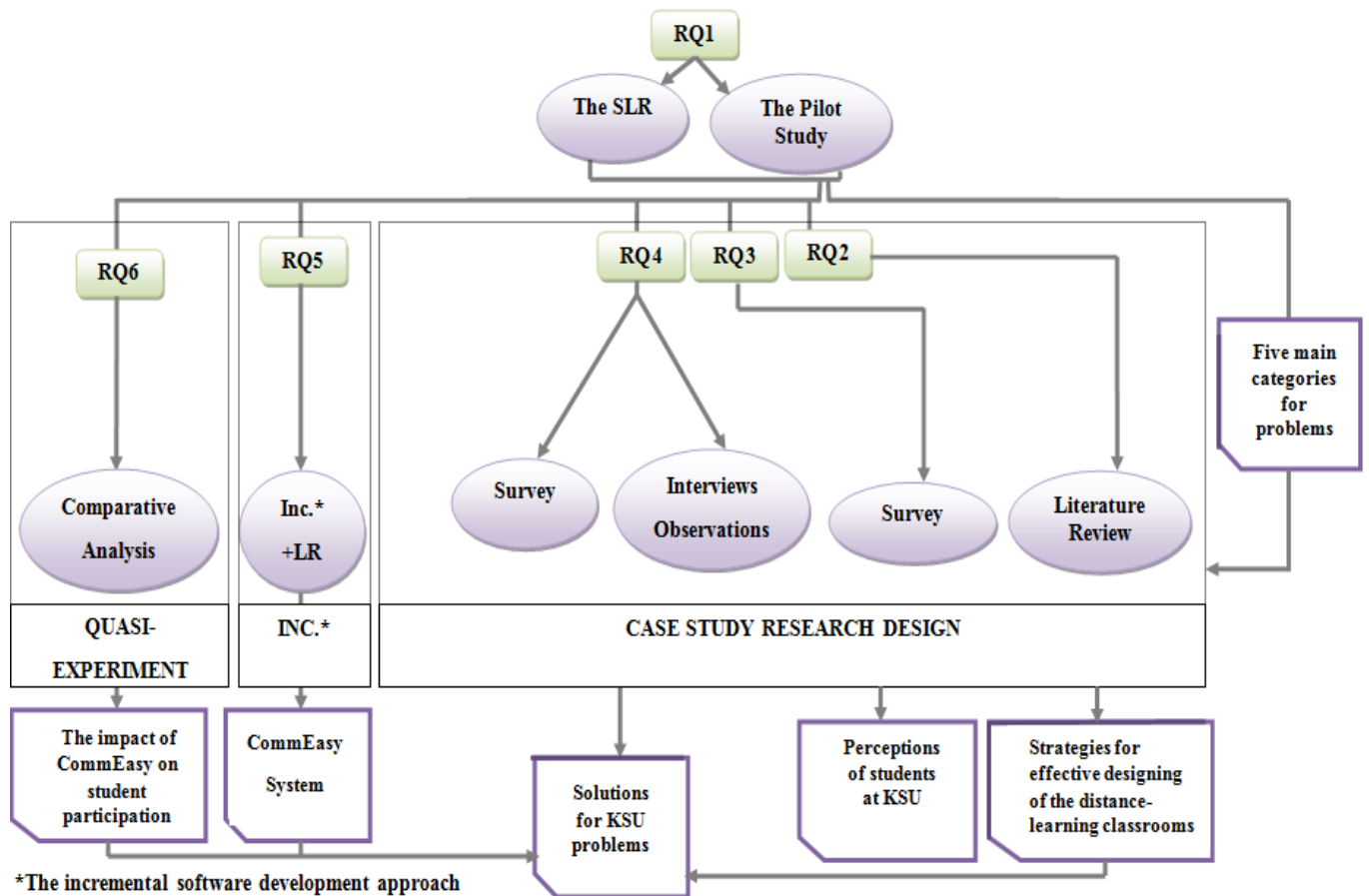


Figure 3.1: Research Process for This Thesis

### 3.2 Methodology to Address the RQ1 (The Pilot Study + the SLR)

An SLR is a methodologically rigorous review of all the literature relevant to a research question. The principal purpose of using an SLR is to ensure that the literature review is objective, unbiased, and rigorous. Initially, this approach was developed in the medical field but was adopted later in many other fields, such as criminology, the social sciences, economics, nursing, education, and software engineering (Petticrew and Roberts, 2006; Kitchenham and Charters, 2007). The SLR is defined as “a means of identifying, evaluating and interpreting all available research relevant to a particular research question, or topic area, or phenomenon of interest” (Kitchenham and Charters, 2007, p.3). It uses to ensure that the literature review is objective and unbiased. This approach helps researchers to identify, appraise, and summarise all of the relevant studies in a topic of interest. They can also employ it to identify a gap in the current literature and discover an area of inquiry that needs further investigation and consideration. Many researchers have discussed and summarised the procedure of conducting the SLR. For example, Kitchenham et al. (2009) discussed the

process of conducting an SLR in the field of software engineering; Petticrew and Roberts (2006) conducted a similar discussion relating to the educational research. However, the procedures of conducting the SLR are similar in most fields (Figure 3.2). The SLR was used in this research to conduct an in-depth investigation into the available literature regarding distance-learning barriers, to identify the most common barriers or problems that students face in this regard, as reported by other researchers. The result of the SLR is presented in Chapter 2.

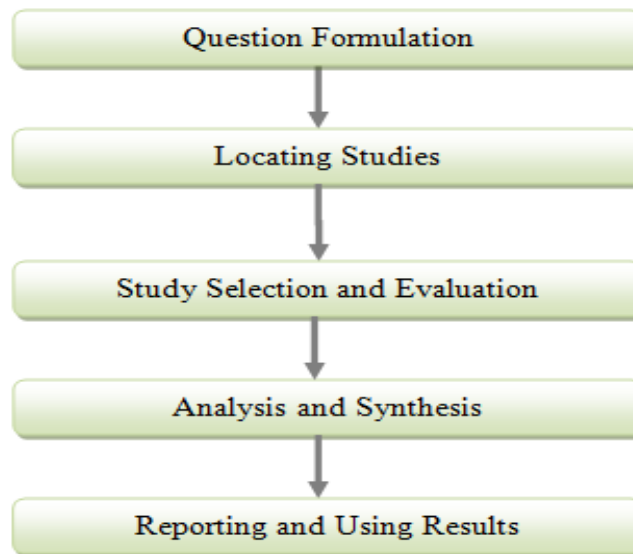


Figure 3.2: Steps for Conducting the SLR

In addition to that and due to a lack of studies regarding distance-learning barriers faced female students in Saudi Arabia, a pilot study involving 229 female students from three public government universities in Saudi Arabia (King Saud University, Princess Nora Bent Abdulrahman University (PNU), Al-Imam Muhammad Ben Saud Islamic University) was conducted at the beginning of this research, which aimed to build a general background about the opinions of female students toward conducting this research, to what extent they are satisfied or dissatisfied with the current distance-learning technologies used at their universities, and to determine the possibility of conducting this research, for example the administrative procedures involved, availability of participants etc. The pilot study was also mainly aimed at building a general background about the existing problems in the distance-learning classrooms, which help later to classify the problems considered in this research to five main categories.

A summary of the pilot study will be presented in this section; this will include: the participants, the data collection instrument, data collections procedures, etc. The results of the pilot study will be presented in detail in the Result Chapter (See Chapter 7).

**Designing the Questionnaire:** Developing the survey of the pilot study passed through several stages, as is the case with the design of the main survey for identifying the perceptions of female students at KSU (See Chapter 3.3.1). However, as most of these stages will be discussed in detail later in this chapter, this section will summarise the main design issues related to the pilot study survey.

In designing the survey, both quantitative and qualitative approaches have been combined. Many researchers have confirmed the importance of mixing these methods to obtain data in research that relate to participants' attitudes and opinions, as will be discussed later in this chapter. The qualitative approach has been used to reveal the opinions of female students towards the problems they faced in this learning environment and any suggestions or comments they wanted to add in this regard. The quantitative approach, which is usually used to collect information quickly and precisely and in a form that is easy to analyse, has been used to gather important information about evaluating those technologies according to some factors such as communication with the male instructor, audio quality, classroom management, etc.

The questionnaire was comprised of three parts: The first part included a set of questions to collect the required data for the pilot study. Some of these questions were open ended, giving students the opportunity to express their opinions regarding the problems they faced in the distance-learning environment in their own words. Another set of questions were closed with either dichotomous (yes/no) or five-point Likert scale answers to choose among. The second part of the survey included an acceptance of participation form to be signed by students who agreed to further participation in this study. The third part was to gather some demographic information about the participants. The demographic questions were placed at the end of the questionnaire because positioning them at the start might have discouraged participation (Bourke and Fielder, 1995). For more information about the questionnaire, see Appendix 3-A. In designing all parts of the questionnaire, three main principles have been taken into account: minimising or limiting bias, appropriateness and cost effectiveness. These will be discussed in detail later in Chapter 3.3.1.

Once the questionnaire was completed it was translated and then evaluated through the focus group, as will be discussed below.

**Translation of the Questionnaire:** the final version was translated into Arabic to ensure students' understanding and to increase the number of participants. The translation has passed through similar stages for translating the main survey for identifying the perceptions of female students at KSU, as will be discussed later in this study (See Chapter 3.3.1). For more information about the Arabic version of the questionnaire, see Appendix 3-B.

**Evaluation of the Questionnaire:** One of the common methods for evaluating questionnaires is the focus group (Fowler, 1995; Presser et al., 2004). The focus group used in evaluation of the questionnaire consisted of a group of ten students who were studying with male instructors in distance-learning classroom at KSU. The purpose of the evaluation was to check that all questions and statements were understandable and easy to answer by the participants. Each student was given a copy of the questionnaire to read and give comments on. The comments given by the focus group were considered and the questionnaire was updated accordingly.

**Participants of the Pilot Study:** The target population for the pilot study was all female students who are studying with male instructors in distance-learning classrooms, through video conferencing or audio conferencing technologies, in Riyadh's universities in Saudi Arabia. In choosing this sample, bias avoidance, appropriateness, and cost-effectiveness were taken into consideration. To choose the sample, all students at the university were contacted via email (with the help of the Dean of Scientific Research) with details of the study, its objectives, the importance of their contribution, the date(s), time(s) and place(s) of the study (i.e. the distribution of the survey), the criteria for enrolling in the study, and a form allowing the students to either accept or refuse participation. This approach helped to fulfil the abovementioned requirements in choosing a sample where bias was avoided by giving all students the same chance to participate in the study and to allow them to freely accept or refuse participation. Students who agreed to participate were met and given the survey to fill in. A paper-based questionnaire was used instead of an online questionnaire to allow to meet the students in person and to ensure that the participants filled it in appropriately, and to identify their opinions regarding conducting this research. The size of the sample was 229 females students; 84 respondents were from Princess Nora bent Abdulrahman University, 74 were from King Saud University and 71 were from Al-Imam Muhammad Ben Saud Islamic University (Figure 3.3). In total, 95% of the respondents were undergraduate students, and 5% were postgraduate. The students' majors are shown in Figure 3.4. All of them were enrolled in at least two distance-learning classrooms with male instructors. The three

universities used the same distance-learning technologies to deliver subjects by male instructors to female students.

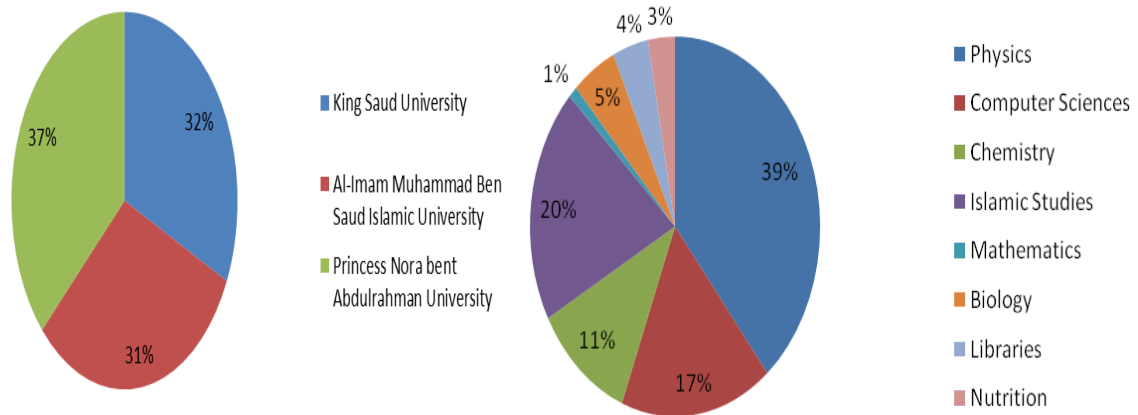


Figure 3.3: Number of Respondents (n=229).      Figure 3.4: Respondents' Majors (n=229).

**Data Collection Procedures:** Data were collected by distributing a paper-based questionnaire in the period between 30<sup>th</sup> September, 2010 to 30<sup>th</sup> October, 2010 in three public government universities in Riyadh, Saudi Arabia – King Saud University, Al-Imam Muhammad Ben Saud Islamic University and Princess Nora bent Abdul-Rahman University. The questionnaire, entitled ‘Perceptions of Females Students towards Video and Audio Conference Technologies in Saudi Arabia’, was developed to gather the required information. Once the required permission was obtained from universities to conduct the study, the questionnaire was distributed among the participants. In conducting the study, the objectives of the study, the importance of its contribution, the expected outcome of the study, etc. were explained to the students, and they were informed that they were free to withdraw from the study and that there were no known risks for them in completing the questionnaire. They were also informed that their identity would be kept secret and would not be used for any other purpose. The questionnaire was then distributed to them with a help of cooperative staff from the university, and students were given time to complete the questionnaire. All queries were answered while they were filling in the questionnaire. Once they had completed the questionnaire, they returned it. The language used in the questionnaire was Arabic, the native language of the participants, as it is more appropriate to ensure participants' understanding.

### 3.3 Methodology to Address RQ2, RQ3 and RQ4 (Case Study Research Design (KSU))

According to Creswell (2007, p.73) the case study is:

“A qualitative approach in which the investigator explores a bounded system (case) or multiple bounded systems (cases) over time, through detailed, in-depth data collection involving multiple sources of information (for example, observations, interviews, audiovisual material, and documents and reports), and reports a case description and case-based themes”

Researchers have been using the case study method for many years and across a variety of disciplines. In the fields of educational and social sciences research, three types of case study are available: exploratory, explanatory, and descriptive case studies (Yin, 2003). Each of these can consist of either multiple or single case(s). Explanatory case studies are suitable for conducting causal studies and can be used with very complex and multivariate cases. A descriptive case study is used to illustrate events and their specific context; this method is widely used in special education research. The last method, that is used in this research, is the exploratory case study which is used widely in educational research. In this method, the researcher undertook a pilot study at the beginning of the research to define the research questions, to determine the framework that the researcher used in the research, and to determine the data collection instruments applied. Despite the classifications associated with the case study method, these three types may overlap in some research.

Researchers who have designed the case study approach, such as Simons (1980), Stake (1995), and Yin (2003), have suggested specific techniques or procedures for organising and conducting case studies successfully. These techniques were summarised by Stake (1995), as Figure 3.5 shows.

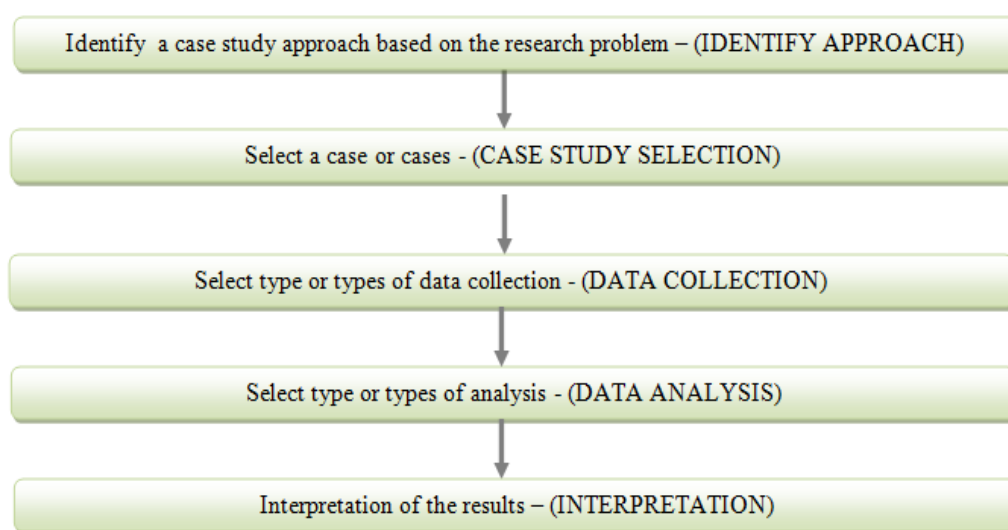


Figure 3.5: Steps for Conducting a Case Study

Following these steps, in this research, the exploratory case study approach has selected and the synchronous distance-learning model in KSU has chosen to be investigated (See Chapter 4). However, as a part of the case study, a literature review was conducted to provide the required theoretical background for the distance-learning in Saudi Arabia, the technologies used in KSU (See Chapter 4), and to discuss the problems students faced (See Chapter 5). This review also resulted in a list of best practices (strategies) for effective designing of the distance-learning classrooms as reported by other researchers. This answers the second research question in this research. Answering RQ3 and RQ4 required the use of further methods, such as surveys, interviews and observations. In the following sections, the design of all these methods is discussed in detail. The data analysis procedures and results will be presented in the Results Chapter (See Chapter 7) and will be discussed in Chapter 8.

### 3.3.1 Method for Answering RQ3: The Survey for Identifying the Perceptions of Female Students at KSU Regarding the Problems They Faced in Distance-Learning Classrooms in KSU

In order to answer the third research question, and to achieve the objectives of this research successfully, the survey approach has been chosen, because it was the most appropriate method to obtain data for this research question. DeVellis (2012, p.48) states that:

“When a construct cannot be measured directly, then a questionnaire that contains scale items that represent the desired construct can be a useful means of measure”

As there is no practical way available for directly measuring student attitudes and perceptions, a survey was found to be a practical and effective method for use in this research. This method is characterised by many advantages, such as:

- It is the preferred methods for obtaining information from a large population and to obtain demographic data that explain the composition of the sample.
- It mostly requires a minimum cost to design and administer, and making generalisations is relatively easy.
- It is a preferred methodology to obtain information about the characteristics, opinions or attitudes, which are not easy to obtain using other techniques (Sproul, 1988; Salant and Dillman, 1994).

- It provides valid and reliable quantitative data regarding attitudes, perceptions, values, behaviours of a population.

However, despite these advantages, survey approach has also its limitations, which include:

- Usually, it is not helpful when an understanding of the historical context of phenomena is required.
- Biases might sometimes occur in survey methods, because of the absence of responses from the intended respondents or because of the nature and accuracy of the answers that are obtained,
- Errors sometimes include the intentional misreporting of behaviours by participants to confound the survey findings or to hide inappropriate behaviour.

In the survey approach, many tools (instruments) can be used to collect data from participants such as questionnaires, interviews etc. In this research, it was decided to design a questionnaire consisting of a number of questions and statements with a five-point Likert scale, for collecting data for this study. Many reasons support this decision, including the following:

- The questionnaire has proven to be a powerful tool for gathering information about the perceptions or the attitudes of the participants, and according to Wiersma and Jurs (2008), it is the most common tool used for this purpose.
- The questionnaire is very useful when the required data for the study are not available from other resources, the required data in this study are not available from other resources because it is the first study to address the perceptions of female students who are enrolled with male instructors in the distance-learning classroom in KSU regarding the problems they encounter in this environment.
- The questionnaire allows data to be obtained from large number of participants in a quick, inexpensive and accurate way. The large number of participants involved in this study makes the questionnaire the preferable method to collect data rather than individual interviews, focus groups, etc.
- According to Radhakrishna (2007), questionnaires are very helpful in gathering information on knowledge, attitudes, opinions, behaviours and for gathering facts and other information.
- Among many measurements used for measuring attitude and perceptions, the most popular method among survey researchers was a questionnaire with a Likert scale,

where participants ranked their level of agreement to the statements with using a five-point scale (Bratt, 1977; Jones and Carter, 2007).

- The results of the questionnaire can be analysed more scientifically than other forms of research methods, e.g. individual interviews, focus groups, etc.
- The Likert scale is viewed by many researchers as “one of the most common item formats” that “is used widely and has proven successful in diverse applications” (DeVellis, 2012, p.93). It is used primarily for assessing opinions.
- The use of a Likert scale format has many advantages, such as improvement of consistency and reduction of the time required for participants to complete the survey.
- The experience of using the Likert format in different studies and settings has proved that it is “familiar and easy to use” (Kaplan and Saccuzzo, 2009). Therefore, it is a helpful and efficient measurement for studying a student’s attitude to the learning environment and its constituents.

All these reasons have supported the decision to use a questionnaire with a five point Likert scale as a main instrument to collect the data about perceptions of female students in KSU toward the distance-learning classrooms. Designing the questionnaire has passed through several stages, as will be discussed below:

**Developing the Questionnaire:** As discussed earlier in this chapter, the results of the SLR were combined with the those of a pilot study (See Chapter 3.2) resulting in the classification of the problems faced by female students in distance-learning classrooms into five main categories: classroom physical design, classroom physical features, technical support, classroom management and finally communication and participation with male instructors. For each of these categories, a set of questions or statements was generated to identify students' perceptions towards different components of this category. For example, with regards to classroom physical design, a set of questions was generated to identify students' level of satisfaction with the current equipment arrangements in the classroom such as microphones, loudspeakers, screens, etc.

The questionnaire included 42 questions and statements generated to identify female students' perceptions towards all the abovementioned categories. Perceptions were measured using a five-point Likert scale. These 42 statements were added to the questionnaire (see appendix 3-C), which was the instrument used to answer the third research question. This questionnaire was developed and then validated by a panel of experts, as will be discussed later in this chapter. Designing this questionnaire involved the following Steps:

**Step 1:** As stated by many researchers, the first step in designing any questionnaire is to set its objectives, which are simply statements of the expected outcomes of the questionnaire (Kitchenham and Pfleeger, 2002; Czaja and Blair, 2005). Setting the objectives is very important because it helps in determining the target population for the survey and in deciding the best approach to gathering the required information within the available time and resources. These should be specified at the beginning of the questionnaire to inform the participants of the purpose of the questionnaire and the expected outcome. In this study, the objectives were set clearly and added to the beginning of the questionnaire and included the following:

“The aim of this questionnaire is to identify the perceptions of female students, who are enrolled with male instructors in distance-learning classrooms in KSU regarding problems they encounter in this learning environment. It also aims to propose some feasible solutions to the most common problems. The findings of this study should provide decision makers in KSU with an insight into these problems and the possible ways they could be solved”

**Step 2:** In designing the questionnaire, it has taken into account the three basic principles for effective design which are: avoidance of bias, cost-effectiveness and appropriateness (Kitchenham and Pfleeger, 2002). In terms of avoidance of bias, it took into account that questions or statements provided should be clear and not unduly swayed by a particular aspect or opinion. In terms of appropriateness, it has ensured that all statements were complex enough to address the objectives of the survey but no more complex than they needed to be. In terms of cost-effectiveness, it has taken into account that the costs of administration and analysis of the questionnaire need to stay within the resources allocated, and also that the results of the questionnaire should be useful for the participants so it is worth their time to complete the questionnaire. These principles were achieved through taking into account many criteria that have been reported by other researchers (Oppenheim, 1999; Kitchenham and Pfleeger, 2002; Willem and Irmtraud, 2007). These included the following:

- Clear and simple language was used to ensure students understood the questions.
- No abbreviations, slang or colloquial expressions were used.
- No difficult terms or terminologies were used.
- Pre-testing of the questionnaire was conducted as will be discussed later.

- Sufficient options were provided for students. Neutral options were used to avoid requiring students to choose either positive or negative answers.
- Open-ended questions were used to give students an opportunity to express their opinions regarding any problems they faced or any comments that they might wish to make.
- Open-ended questions were kept to a minimum in that just 2 such questions were used. This was to avoid fatigue and optimize the quality of the responses received.
- Complete sentences (questions) that expressed a single idea were used.
- The questions were written in such a way as to be precise and unambiguous.
- The order of the questions was such that they would not affect the results of the study.
- A paper survey was the preferred type rather than an online or mobile survey. This was because it was preferred to meet the participants in person, to make sure that they understood the questions and to answer their enquires.

**Step 3:** As mentioned before, the 42 questions and statements included in the questionnaire represented the most common problems identified from both the SLR and the pilot study. For simplicity, these statements were grouped into 4 main themes:

- Classroom physical design: This included a set of questions asking students about their level of satisfaction or dissatisfaction with the current classroom equipment arrangements. Students were asked to respond to each question by choosing the answer that best represented their level of satisfaction or dissatisfaction. The student can, respond to each question, using a five-point Likert scale, as: very satisfied, satisfied, neutral, dissatisfied, or very dissatisfied
- Classroom physical features: this included a set of questions asking students about their level of satisfaction or dissatisfaction with the current classroom physical features such as lighting, temperature, etc. Students were asked to respond to each question by choosing the answer that best represented their level of satisfaction or dissatisfaction. This part consisted of 22 questions. Respondents were asked to respond to each question, using a five-point Likert scale, as: very satisfied, satisfied, neutral, dissatisfied, or very dissatisfied.
- Technical support for the classroom: this included a set of questions asking students about their level of satisfaction or dissatisfaction with the current technical support provided by KSU for distance-learning classrooms and the role of the technical assistants in this regards. Students were asked to respond to each question by

choosing the answer that best represented their level of satisfaction or dissatisfaction. This part consisted of 4 questions. Respondents were asked to respond to each question, using a five-point Likert scale, as: very satisfied, satisfied, neutral, dissatisfied, very dissatisfied

- Classroom management, communication and participation with instructors: this included a set of statements representing some common problems faced by students in terms of classroom management, communication and participation with male instructors in distance-learning classrooms. These statements resulted from the pilot study. For each statement, the students were asked to express their level of agreement or disagreement with each point of view included in the statements. This part consisted of 7 statements. For each statement, respondents were asked to respond to each statement by using a five-point Likert scale: Strongly Agree, Agree, neutral, Disagree and Strongly Disagree.

**Step 4:** A cover page for the questionnaire has provided, which explains to the participants the important issues related to the study, such as the benefits of the study, its risks and confidentiality. The cover page also includes full contact details for the researcher (See Appendix 3-D).

**Step 5:** At the end of the questionnaire, an acceptance participation form has been provided. It includes details that would enable the participants to obtain the study results when they become available (See Appendix 3-E).

**Step 6:** It has been also taken into account that all instructions provided in the questionnaire are clear and understandable.

**Step 7:** It has been also taken into account the presentation of the questionnaire, such as font, spacing, etc. and recommendations provided by researchers in this regards were followed.

Finally, once the questionnaire was designed, the next stage was the translation, as described in the section below.

**Translation of the Questionnaire:** to ensure that the participants could understand the questionnaire and complete it in an appropriate way, the final version of the questionnaire was written in the Arabic language. The survey was first developed in English and then translated into Arabic. An Arabic faculty member of The School of Modern Languages and Cultures, Department of Arabic Language at Durham University was asked to translate the English version of the survey into Arabic. After the translation, the two Arabic versions of the survey (the one translated by the researcher and the second translated by the Durham

faculty member) were given to a panel of experts consisting of 7 Arab masters and doctoral students in the UK, who provided their comments on the survey and any changes required (See Appendix 3-F for experts details). Their comments were taken into account when finalising the Arabic version. The Arabic version of the questionnaire then translated back into English to check its accuracy, and the new English version was also rechecked by the same panel of experts. There were slight differences in the new translated English version, but the process nevertheless was very helpful in producing a more accurate Arabic version of the questionnaire (See Appendix 3-G.).

**Evaluation of the Questionnaire:** Many researchers have reported that evaluation of the questionnaire is a very important step in the design process of the questionnaire (Kitchenham and Pfleeger, 2002; Saris and Gallhofer, 2007). The evaluations allow us to make sure that the contents of the questionnaire such as questions and instructions are clear and understandable; to identify and assess the expected response rate and the effectiveness of the follow-up procedures, to make sure that the questionnaire is reliable, to validate its contents and to assess the procedures of data analysis. In evaluating the questionnaire, two evaluation methods has used: the first method is the pilot study and the second is a panel of experts. These two methods are the most common ones used for the evaluation of a questionnaire as reported by many researchers (Fowler, 1995; Kitchenham and Pfleeger, 2002). In this study, a pilot study was administered to a group of 50 female students who were enrolled in distance-learning classroom with male instructors at KSU in the first semester of 2011/2012. The participants were provided with an introductory form to inform them about the importance of their participation in this evaluation (See Appendix 3-H). At the end of the form, the participants were asked to answer some questions that were used later to improve the questionnaire. Examples of the questions are provided below:

- Are the instructions at the beginning of the survey understandable?
- Is the scale used clear and understandable?
- Would you recommend any changes?
- Do you have any additional comments?

In conducting the evaluation, the Arabic version of the questionnaire was used. The students provided some suggestions that were taken into account; these suggestions were discussed with the supervisor and the questionnaire was improved accordingly.

Another method to evaluate the questionnaire and insure its validity is by using a panel of experts (Kitchenham and Pfleeger, 2002; Johnson and Christensen, 2008). The panel of

experts was chosen and requested to evaluate the questionnaire and give their insight and suggestions to improve the questionnaire. This panel had the basic role of validating the content of the questionnaire as they were from the same discipline and some of them were from the same research group. The panel of experts played a vital role in validating a great deal of content and procedures during this research. For the names of all experts involved in this thesis, please see Appendix 3-F. The questionnaire was combined with a letter to the panel to thank them in advance for their contribution to the study and included a form containing questions for the panel regarding the content of the questionnaire (See Appendix 3-I). According to their comments and suggestions, the questionnaire was improved and revised to confirm the last version.

**Population of the Survey:** The target population for this case study was undergraduate female students who enrolled in distance-learning classrooms with male instructors in the College of Computer and Information Sciences, Department of Information Technology, in KSU Riyadh, Saudi Arabia. KSU was chosen as the place to conduct the study for several reasons, as follows:

Firstly, KSU currently is one of the best universities in Saudi Arabia. KSU's main website (2011) cites it as the Islamic world's leading university, according to the Academic Ranking of World Universities (ARWU). It is placed among the best 300 universities in the world, at No. 261, a standing never achieved before by any other Arab university. It has also achieved prominence among Arab and Islamic universities in the Spanish Webometrics, positioned at No. 186 and thus –among the best 200 universities in the world and the highest of all Arab and Islamic universities. The British QS Times rankings lists KSU among the best 300 universities in the world, at No. 221. The university makes a tremendous effort to support and facilitate researchers and this is one of the main reasons for choosing it as the venue for this study (KSU, 2011).

Secondly, the researcher is employed as a lecturer in the College of Computer and Information Sciences in Princess Nora bent Abdulrahman University. Government public universities usually cooperate and provide support for each others' members. This fact facilitated procedures related to the study, for example, obtaining permission to conduct the study quickly and smoothly, the presence of easy access to any required demographic information about the participants, and direct communication with decision makers regarding any queries, questions or requirements concerning the study.

Thirdly, KSU will open a new campus during the next few years that will be equipped with the latest technology. They will take into account any suggestions for improvements from researchers and this study will help provide insights about problems with current technologies together with possible solutions. This should be useful not only for KSU but also for all other universities in Saudi Arabia, most of which have worked towards improving their current buildings and technologies, as advised by the Ministry of Higher Education (KSU, 2011).

Finally, KSU has recently been assigned a large budget from the government of nearly 9 billion Saudi Riyal (2.4 billion USD) which is the largest assigned for the university since it was established 55 years ago and larger than that assigned to any other university in Saudi Arabia. Consequently, such a budget will facilitate the implementation of any suggestions for improvements (KSU, 2011).

The target population for this study included all females students enrolled in the College of Computer and Information Sciences in KSU. As Kitchenham and Pfleeger (2002) point out, it is not usually cost effective (and often not even possible) to survey the entire population. Instead, a subset of the population, a sample, is selected to represent the entire population. The sample used in this study and the sampling procedure will be discussed in the section below.

**Sample and Sampling Procedures:** the three primary aspects mentioned by Kitchenham and Pfleeger (2002) have been taken into account in choosing the sample:

- Resilience to bias.
- Appropriateness.
- Cost-effectiveness

According to Kitchenham and Pfleeger (2002) taking these principles into account leads to the selection of a sample that is truly representative of the larger population, appropriate to involve in the study, not prohibitively expensive, and it is more likely to obtain reliable and precise findings (Kitchenham and Pfleeger, 2002). The purpose of this study is to identify the perceptions of female students with regard to distance-learning classroom components and to identify problems which they encounter in such classrooms. According to many researchers, identifying the participants' perceptions can be affected by many variables such as the participant's gender, age, educational level (undergraduates or postgraduates), the subject taught, academic majors, and whether studying full-time or part time (Aytekin, 1997; Borrowdale, 2000; Lee, 2002; Başak and Dabaj, 2008; Isman et al., 2004). The differences in students' perceptions according to these variables have been researched and considered by

many researchers. For example, according to Dabag and Basak (2008), students' perceptions with regard to distance-learning components will differ according to age, gender. Lee (2002) reported that there is a significant difference in students' perceptions with regard to classroom design in distance-learning according to gender, major and educational level (whether students are undergraduates or postgraduates). Baroum (2005) stated that there is a significant difference in students' perceptions with regard to distance-learning according to major and educational level (whether students are undergraduates or postgraduates) but no a significant difference according to gender.

However, this study does not aim to study such differences as these have been studied extensively, and there are hundreds of publications that have discussed such an issue, both nationally and internationally, and a variety of results have been recorded in this respect. This research is interested in identifying the perceptions of female students toward the components of the distance-learning classroom that use video conferences technology in order to evaluate the current learning environment, the technologies that are used, and the role of new technologies in improving the learning experience of students. It also aims to solve the problems the female students reported. However, to control the above-mentioned variables, the sample chosen in this research demonstrated were similar demographically. All students were full-time undergraduate students who had the same major (CS), were of the same age group (20-25), and were involved in studying the same subject at the time of filling in the questionnaire (IS). The five main components of the learning environment that will be considered are as follows:

- The study will consider the perceptions of female students toward the current arrangements of classroom equipment such as microphones, loudspeakers, screens etc., and will explore to what extent students are satisfied or dissatisfied with these components, and will propose feasible solutions accordingly.
- It will consider the perceptions of female students toward the current physical features of the classroom such as lighting, temperature, acoustics etc., and will explore to what extent students are satisfied or dissatisfied with these features and will propose feasible solutions accordingly.
- It will consider the perceptions of female students toward the current technical support provided by the university for distance-learning classrooms, such as maintenance services, working order of equipment, etc., and will explore to what

extent students are satisfied or dissatisfied with the technical support and will propose feasible solutions accordingly.

- It will consider the perceptions of female students toward other important components in this learning environment such as classroom management, communicating and participation with the male instructors, and will clarify the problems that students faced in this regard and will then propose possible solutions.

The characteristics of the study participants were as follows: full time female students with a major in Computer Science; age between 21-25 years old; involved in an Islamic Studies subject at the time of filling in the questionnaire. A paper questionnaire was distributed to 112 students; 100 returned the survey. The 100 students who made up the sample agreed to participate in the study through to its completion, and signed a letter of agreement.

**Data Collection Procedures:** When all stages of designing the questionnaire and validating its content were finished, the data collection process started. The official communication required to obtain the permissions for conducting the study was carried out (See Appendix 3-J). Once permission was obtained (See Appendix 3-K), the study proceeded during the second semester of the 2011-2012 year (second semester 1432-1433 H) at the Mallaz Campus of KSU. The study was under the direct supervision and support of The Dean of Graduate Studies and Scientific Research at KSU; When completed the study, a confirmation letter of data collection in both Arabic and English was given by the Dean of Graduate Studies and Scientific Research (See Appendix 3-L).

Obtaining the necessary permission and consent is very important part of conducting research and comprises a vital component of research ethics involving humans (Winter, 1996; Israel and Hay, 2006). Ethical considerations are a fundamental component of any research, which must be conducted with relative openness, accuracy, honesty and scientific impartiality (Cohen et al., 2011). All these ethical issues have been discussed earlier in this chapter.

### 3.3.2 Methods for Answering RQ4: Instruments Employed for Proposing Solutions for KSU Problems

To contribute to answering question four (RQ4) and providing solutions for problems reported by female students in KSU, two more further studies using different methods were conducted regarding solutions for classroom management problems. One of the solutions was related to providing students with appropriate preparation and training before they attended distance-learning classrooms with male instructors, another solution proposed appointing a

female teacher assistant to help in classroom management. These will be discussed in the next two sections.

### 3.3.2.1 The Role of Students' Preparation in Reducing Discipline Problems in Distance-Learning Classrooms in Saudi Arabia

**The Purpose of the Study:** The purpose of this study was to collect data about the current efforts of the KSU and the male instructors in providing appropriate preparation for female students before they joined distance-learning classrooms and the role of such preparation in reducing discipline problems in the distance-learning classrooms in KSU.

The preparation in this context relates to two aspects: first, create awareness among females students about distance-learning technologies, e.g., the advantages and limitations of these technologies, the differences between these technologies and the traditional classroom, and dealing and communicating with males instructors. Secondly, create awareness among female students about the rules and regulations of the university regarding managing the students' behaviour and what the consequences of breaking such rules. The results of this study will provide insight into the importance of the mentioned preparation and the current effort of the university and instructors in this regard. It will also help to understand the reasons that cause disciplinary problems.

**Designing the Questionnaire:** The questionnaire, entitled "The importance of students' preparation in reducing discipline problems in distance-learning classrooms that using video conferencing technology in KSU", was developed to gather the required information. In designing this questionnaire, both qualitative and quantitative research methods have employed (Kitchenham and Pfleeger, 2002). The procedures used in developing this questionnaire are similar to the procedures used in designing the questionnaire discussed in Chapter 3.3.1 and, therefore, they are not repeated here. The objectives of the questionnaire were to explore the importance of the above-mentioned preparation in reducing discipline problems from the students' point of view, to explore the efforts of both the KSU and the male instructors in providing such preparation, and, finally, to identify the reasons for these problems. For more information about the questionnaire see Appendix (See Appendix 3-M).

**Translation of the Questionnaire:** The questionnaire was developed in English and then translated into Arabic. The Arabic version of the questionnaire was evaluated and improved by two experts who were PhD students from the School of Modern Languages and Cultures,

Department of Arabic Language, at Durham University. The questionnaire was improved accordingly (See Appendix 3-N).

**Evaluation of the Questionnaire:** To evaluate the questionnaire, 15 students were chosen and asked to complete the questionnaire and provide their comments. The questionnaire was improved accordingly.

**Participants:** the study involved 100 female students who agreed previously in participation in this research.

**Data Collection Procedures:** Data were collected by distributing a paper-based questionnaire in the period between the 25<sup>th</sup> December 2011 and 25<sup>th</sup> March 2012 at the Mallaz Campus in KSU. The questionnaire was supervised in that the participants were observed during the process of filling it in, in order to answer any queries the participants might have.

### 3.3.2.2 The Role of the Teaching Assistants in Synchronous Distance-Learning Classrooms in KSU

**Purpose of the Study:** The purpose of this study was to investigate the role played by the teaching assistants in the distance-learning classrooms and how they contribute in reducing discipline problems in the classroom.

**Data Collection Instruments:** a qualitative research design was used. This incorporated semi-structured interviews and observation, with the basic themes of the interviews determined by the researcher. The themes emerged following a review of the available literature regarding the possible roles of the teaching assistant in classrooms. The participants were asked for permission to record the interviews as a means of better analysing the data. It was explained to the students that the material would only be used for study purposes and destroyed once the study was completed. However, only three students agreed to recorded interviews, with the others documented on paper only. During the lectures, a good relationship with the students was built. This helped to discover their views on the role of the teaching assistant and to obtain deeper and more important information from the students.

**Participants:** The study was conducted at King Saud University (KSU) between the 25<sup>th</sup> December 2011 and 25<sup>th</sup> March 2012. The participants were a female teaching assistant and 15 students at Mallaz Campus who had enrolled in the Islamic Studies module taught by a male instructor. Before beginning the study, permission was sought from the male instructor

to attend all lectures in the module during the term. The instructor kindly agreed, and the female teaching assistant agreed to participate and cooperate.

**Data Collection Procedures:** Interviews were conducted in Arabic, then the manuscripts translated into English. The original and translated transcripts were given to an external researcher, a PhD student from the Department of Arabic in the School of Modern Languages and Cultures at Durham University. The comments provided by the external researcher were taken into account. Once the manuscripts were approved, the data analysis was begun in order to compile the findings and conclusions as will be discussed in Chapter 7.

### **3.4 Methodology to Address RQ5 (The Incremental Approach for Software Development)**

An incremental software development approach was used to develop an innovative interactive communication system (CommEasy System) that used to support and enhance communication and participation in the distance-learning classrooms.

### **3.5 Methodology to Address RQ6 (The Quasi-Experimental Method for Evaluation of the CommEasy System)**

In order to evaluate the CommEasy system, many evaluation metrics were considered, such as the usefulness of the system in supporting and encouraging students' participation, to what extent the system helped to solve the problems the students faced in communication with male instructors, to what extent students' participation was affected with and without the use of the system, usability and convenience of use. The evaluation process will be discussed here. However, the results of the evaluation will be presented with all other results of the thesis in the Results Chapter (See Chapter 7).

The evaluation strategy employed here was based on conducting a quasi-experiment by allowing the students and instructors to use the system in the actual learning environment to communicate and interact with each other. The experiment took one month and the participants were a group of 30 female students from the College of Computer and Information Sciences at KSU, who are enrolled in a distance-learning classroom with a male instructor in the 'Islamic Studies' module. The system was first explained to the students and then a short demonstration about how it worked was presented. A link to download the system was then provided for the students and ensure that all the systems downloaded onto the students' devices were working properly. The students were also provided with a six page

manual included FAQ on the use of the system and its different components. The utility of the CommEasy system was assessed through two methods: the comparative analysis and the questionnaire, as will be discussed below.

### 3.5.1 The Comparative Analysis:

One useful way in which to explore the value added by any new learning tool is by running the classroom both without, and with, the use of the tool and then making a comparative analysis between the two outcomes. This strategy was adopted to evaluate the system presented in this thesis, in order to explore how the students' participation and communication in the classroom was affected, with and without use of the system.

**Evaluation Process:** The purpose of the quasi experiment was to ascertain whether or not the system helped to increase and encourage the participation of female students in the distance-learning classrooms, especially students who were embarrassed or hesitant in speaking to the male instructors and asking questions. This was done by comparing the students' level of participation without using the tool with their level of participation when using it. The students normally participate with male instructors by leaving their seats and walking to the microphones located on walls, where they push the microphone and speak with the male instructors. By using the CommEasy system, students can use their own handheld devices, login to the application and post their questions to the instructors who will receive the questions on their own application. This system guarantees complete anonymity and they can receive answers for their questions back on their devices, once they have been answered by their instructors.

**Hypothesis:** The hypothesis was that the use of the CommEasy system would increase female students' participation in the distance-learning classroom and solve the problems students faced in this regard.

**Data Collection and Analysis Procedures:** The utility of the system was analysed by observation and by counting the amount of participation (questions, comments, etc.) students had in the traditional environment, without using the system, and counting the amount of participation of the same students, when using the system. To control other variables as far as possible between the two conditions (without and with CommEasy), a quasi-experiment was conducted in the same distance-learning classroom and was based on the same subject (Islamic Studies). The lecture topics were almost similar and this was chosen according to the instructor's advice. The lectures were held at the same time every week. A total of 30

participants were chosen randomly from 63 students, and they freely agreed to participate in the study. Four lectures were observed over a four-week period, and the students' participation in the two conditions (without and with CommEasy) has been recorded in the table. By comparing the average of these records, the utility of the tool can be evaluated. The results of the evaluation, along with data analysis techniques, will be discussed in the Results Chapter (See Chapter 7).

### 3.5.2 User Questionnaires

As stated previously in this chapter, the questionnaire is one of the most useful methods to identify people's opinions, perceptions, etc. As the CommEasy system presented in this thesis included two applications, the student application and the instructor application, two different questionnaires were designed to evaluate the system, one aimed at students and the other for their instructors. The students' questionnaire was an important method to evaluate the role of the CommEasy system in supporting the students' participation with male instructors and solving the problems which the students in this study reported they faced. However, the instructor questionnaire was also important as it helped to improve the CommEasy system and understand the strengths and weaknesses from the instructor's point of view. An online questionnaire was used because it is a cheap and fast way of gathering information and allows participants to express their opinions without any bias (Stopher, 2012). The questionnaire was designed and distributed using the survey website "Survey Monkey". The link to the questionnaire was sent to all students who participated in the experiment and all responded. The details of the two questionnaires are discussed below.

#### 3.5.2.1 The Students' Questionnaire

**The Purpose of the Questionnaire:** The objective of the students' questionnaire was to explore the perceptions of the students towards the CommEasy system presented in this thesis and to assess to what extent the system helped to solve the problems they faced in communication and participation with male instructors in distance-learning classrooms. It also aimed to evaluate the system according to some metrics, such as ease of use, ease of run, clarity of guidelines, etc. Its further aim was to identify the advantages/disadvantages of the system from students' points of views and gather students' suggestions and comments.

**Data Collection Procedures:** Data was collected by distributing an online questionnaire in March-April 2014. The link to the questionnaire was sent to the students by email.

**Participants:** 30 female students who were enrolled in an Islamic Studies module with male instructors at the Mallaz Campus in KSU completed the questionnaire.

**Designing the Questionnaire:** The design of this questionnaire passed through similar steps to those mentioned earlier in this chapter (See Chapter 3.3.1), so this information will not be repeated here. To sum up, the questionnaire included two parts: the first part evaluated the role of the system in solving the problems students faced in communication and participation with male instructors, which were reported by students in this thesis. In this part students were asked to express their level of agreement with a set of items by using a five-part Likert scale (Strongly Agree, Agree, Neutral, Disagree and Strongly Disagree). The second part was used to evaluate different aspects of the system according to some metrics, such as ease of use, convenience of use, quality of help, the GUI, etc. The last part comprised open-ended questions which asked students about the advantages or disadvantages of the system, as well as their suggestions for improvement. For more information about the questionnaire see appendix 3-O. The results of the evaluation will be presented in the Results Chapter (See Chapter 7).

**Evaluation of the Questionnaire:** A group of five experts in the similar fields (Computer Sciences, Software Engineering and Technology Enhanced Learning) were asked to evaluate the questionnaire and give their comments. The experts were given a form to complete. The questionnaire was improved according to the experts' comments.

**Translation of the Questionnaire:** The questionnaire was developed in English and then translated into Arabic. The Arabic version of the questionnaire was evaluated and improved by two experts who were PhD students from the School of Modern Languages and Cultures, Department of Arabic Language, at Durham University. The questionnaire was improved according to their comments (See Appendix 3-P).

#### 3.5.2.2 The Instructor Questionnaire

**The Purpose of the Questionnaire:** The instructor questionnaire was used in a similar manner to the student questionnaire, to explore the perceptions of the male instructor toward the system and how they perceived the system in terms of facilitating communication between them and their female students. It also aimed to identify the advantages/disadvantages of the application from instructors' points of view and gathered their suggestions and comments.

**Data Collection Procedures:** Data was collected by distributing an online questionnaire in April 2014. The link to the questionnaire was sent to the instructors by email.

**Participants:** one male instructor from KSU have helped in evaluation of the system.

**Designing the Questionnaire:** The questionnaire contained two parts: the first was about the role of the system in facilitating the communication between students and instructors. The second part was used to evaluate different aspects of the system according to some metrics, such as ease of use, convenience of use, quality of help, the GUI, etc. The final part was open-ended questions which asked students about the advantages and disadvantages of the system, as well as their suggestions for improvement. For more information about the questionnaire see appendix (3-Q). The results of the evaluation will be presented in the Results Chapter (See Chapter 7).

**Evaluation and Translation of the Questionnaire:** The same procedures used for evaluation of the student questionnaire, as mentioned above, were used for evaluation and translation of the instructor questionnaire. For the Arabic version of the questionnaire see Appendix (3-R).

### **3.6 Summary**

This chapter discussed the methodology of the research. The research design and methods employed to answer the research questions posed in Chapter 1 have been discussed in detail. All the instruments built to collect data in this thesis have been presented in this chapter, with a detailed description of the design, translation and evaluation of these instruments. The next chapter will provide essential theoretical background of women's education in Saudi Arabia, will discuss the efforts of Saudi universities regarding distance-learning and will discuss the distance-learning model used at KSU to teach female students by male instructors.

# 4 Case Study of Women's Education in Saudi Arabia

This chapter discusses the education of women in Saudi Arabia and the efforts made by Saudi universities regarding distance-learning. It also provides a detailed description of the distance-learning environment at KSU, which is the learning environment to be evaluated in this study.

## 4.1 Saudi Arabia

As this study related to Saudi Arabia, this section provides the reader with a basic understanding of some features of the society to which this study relates.

### 4.1.1 Saudi Arabia Geographical and Cultural Context

Saudi Arabia is a country in South West Asia with a population of approximately 27 million people; 68.9% of them are Saudi citizens and the percentage of Saudi females is 49.1% according to the last official report of the Saudi Geological Survey (Saudi Geological Survey, 2013). It is the largest Arab country of the Middle East and occupies about 70% of the Arabian Peninsula and its size is more than 2 million square kilometres (Saudi Geological Survey, 2013). It was united under the name of “Kingdom of Saudi Arabia” in 1932 by King AbdulAziz Ibn AbdulRahman Al Saud. Geographically, desert covers more than half the total area of Saudi Arabia and the weather in general is between hot and moderate. There are 13 administrative regions in Saudi Arabia, namely: Riyadh, Macca, Madinah, Qassim, Eastern Province, Asir, Hail, Tabuk, Al-Baha, The Northern Border, Al-Jouf, Jizan, Najran and all administrative regions are divided into provinces. The official religion is Islam and the official language is Arabic. Oil profits have allowed Saudi Arabia to build a broad-based educational system, resulting in an 85.0 % literacy rate (UNDP, 2010). This percentage is seen by the government and Saudi citizens as a considerable accomplishment for the country. In 1970, Saudi Arabia was one of the lowest literacy rate in the region with 15% for men and 2% for women. Comparing this percentage with the current percentage gives a positive impression of the progress achieved by the country in the field of literacy (UNDP, 2010). The

Government has given more care in recent years to the education of both males and females and this has resulted in a powerful educational system, which provides free education to both male and female students between 6-18 years old in the Government's schools under the supervision of the Ministry of Education. Also, higher education is provided free to most secondary school graduates. The King and the Government have given special care to this sector as will be proved during this research.

#### 4.1.2 Overview of Education in Saudi Arabia

After the establishment of Saudi Arabia, education was limited to individual instruction in mosques in urban areas and was not accessible to everyone. In these schools, Islamic law and basic literacy skills were taught to students. Formal education in Saudi Arabia started in 1926, for boys only, when the first primary school syllabus was prepared under the newly established Education Administration (Al-Salloom, 1988). The education of girls in Saudi Arabia started 15 years later than that of boys (Al-Salloom, 1988).

Before 1940, there was some evidence that there were some schools for girls where religion was taught to students (Al-Rawaf, 1990). However, The first elementary school set up for girls was in 1941 in Mecca (Al-Rawaf, 1990) but most people of Mecca, at that time, were not interested in girls' education and the initiative came from foreigners (Abdullah, 1973). The second school was opened in 1947 and was an elementary school (Al-Rawaf, 1990). In 1953 an intermediate school was opened (Al-Rawaf, 1990) and another intermediate school was opened in 1958 in Riyadh (Abdullah, 1973). In 1961, the General Presidency of Girl's Education was set up. After its establishment, few Government schools for the intermediate and secondary schools levels were opened in Mecca (Abdullah, 1973). In general, the opportunity for girls to go to school in Saudi Arabia was growing slowly in the 1950's and this opportunity increased dramatically over the next forty years. The numbers of schools increased and were distributed amongst the major cities in the country such as Macca, Riyadh, Dammam, Jeddah, Madinah and Tabuk (Al-Rawaf, 1990). During the 1990's there has been great progress in girls' education as will be proven later in this thesis.

It should be noted that the education of males and females has developed separately because of the strict segregation of sexes in Saudi Arabia in administration and faculties, in education and employment, and also, because formal education for girls was established much later than for boys. Although both streams are similar in structure, objectives and policy, they were supervised by different Government bodies,(General Presidency of Girl's Education and the

Ministry of Education) until 2004 when King Abdualh ben Abdulaziz combined the General Presidency of Girl's Education with the Ministry of Education under the name of Ministry of Education, which became responsible for supervising education for both males and females. At the present time, education in the Kingdom of Saudi Arabia consists of the following:

1. General education which is divided into three stages:
  - a. The Primary stage.
  - b. The Intermediate stage.
  - c. The Secondary stage.
2. Instructors Qualifying Institutes.
3. Adult Education and Combating Illiteracy.
4. Private Education.
5. Technical Education and Vocational Training.
6. University Education.

However, it is beyond the scope of this research to discuss all of those components. Therefore, this research focuses on higher education, and, especially, females' higher education.

#### 4.1.3 Overview of Higher Education in Saudi Arabia

According to Al-Salloom (1991), higher education in Saudi Arabia began in 1926 when, with the support of King Abdul Aziz, the first group of students was sent out of Saudi Arabia to continue their higher education since there were no higher education institutions in the Kingdom at that time. In 1953, two instructors training colleges were established in Macca and Riyadh. The Saudi Government was encouraged to open more universities due to the increased number of high school graduates and the need for national cadres in various fields. The first university was KSU in Riyadh, established by Royal Decree in 1959 (KSU, 2010). It consisted of 17 colleges and institutes. Other universities were established subsequently. Up until 2002 there were eight universities in Saudi Arabia and by 2010, there were 24 high-capacity universities, distributed throughout the Kingdom regions. These universities are being supervised by the Ministry of Higher Education and have acquired a very high level in independence of academic and administrative scopes (MOHE, 2010).

In addition to these public universities, there are many private universities, accredited by the Ministry of Higher Education (MOHE, 2010). In general, the education and higher education

sector receives more than 55\$ Billion in 2012-2013 from the Government and continues to develop rapidly (MOHE, 2013).

#### 4.1.4 The Higher Education of Females in Saudi Arabia

Because Islam dictates the segregation of the sexes in almost all situations, female education in Saudi Arabia was build and developed according to this principle. The Saudi Government has made great efforts and given a lot of care to the female higher education system. This system was established by Royal Decree on 30 April 1968 (Al-Rawaf, 1990). Under this system a committee was established, including highly educated members, to study all aspects of female higher education in Saudi Arabia, and to set the guidelines for the implementation of this project. The primary result of this project was the establishment of the first female college in Saudi Arabia in 1970 under the supervision of the General Presidency of Girl's Education (Al-Salloom, 1995) with the goal of preparing girls for teaching. Gradually, the General Presidency of Girl's Education found that they had to open new colleges to meet the demand for places so they opened 12 colleges in different regions of Saudi Arabia between 1970 and 1980 and those colleges offer bachelor's degrees in various majors of arts and science (Al-Salloom, 1995). Between 1979 and 1984, 14 Junior Colleges for girls were opened by the General Presidency of Girl's Education in fourteen cities around the Kingdom (Al-Rawaf, 1990). Their goals were to educate the girls, according to Islam, to prepare them for motherhood, and to participate in society. They also aimed to train suitable candidates as elementary school instructors and to develop instructors who were working already in elementary schools (Al-Rawaf, 1990). In the Junior Colleges, students studied for two years to obtain an intermediate diploma in education in a subject area (Al-Rawaf, 1990).

In terms of universities, the Kingdom's universities were established for men, and co-education was not accepted. However, because of the demand, the universities opened some colleges to girls, establishing separate campuses for them in most Saudi universities. The Government has continued to build female higher education institutions and the number of females enrolled in these institutions has increased to 70% of the total students enrolled in higher education in 2009 (Elerini, 2009). The Government has continued to develop its work, which has been realized in several ways including increased female admission to institutions of higher education, providing female education with the latest equipment, providing female education with buildings and tools, which support the learning-teaching process, and supporting the increasing numbers of female members of faculties in higher education

institutions. Also, through the King Abdullah's Foreign Scholarship Program (KAFSP), the Government has funded and supported females to develop their higher education and given them a chance, when they wished, to study abroad.

In 2006, a female-only university was established in Riyadh under the name of Riyadh University for Girls that changed later to Princess Noura bint Abdul Rahman University (PNU, 2013). In addition to that, the Ministry of Higher Education gave women opportunities to enroll in twenty three public universities in different regions of the Kingdom and provided opportunities for private higher education in some regions of the Kingdom.

#### 4.1.5 Background of Gender Division in Saudi Arabia

Since the establishment of the Saudi Arabia by King Abdulaziz ben Abdularahm Al Saud, the King has maintained the belief that Saudi Arabia must follow the Islamic Principles and must follow *Sharia* as laid down by the *Quran* (Islam's Holy Book) and Prophet's *Sunnah*. This is confirmed by the country's Basic System of Governance. As a result, all systems and policies adopted in Saudi Arabia must adhere to Islamic principles. These principles affected the role given to males and females in Saudi society. However, the fact that the roles are assigned on the basis of gender has been accepted in many societies who use this as a way of social organization. In Saudi Arabia, as is the case in most Islamic countries, the role of males and females are considered as complementary rather than equal (Rassam, 1984). El-Guindi (1981, p.477) noted that:

“One basic feature of Arab socio-cultural organization is the division of society into two separate and complementary worlds, the men's and the women's. In Saudi Arabia this division is strict: sexes do not mix”

The Saudi policy-makers have always tried to preserve the traditional social order and gender role divisions in all systems and policies which the Government has established. The education system is one of the systems in Saudi Arabia to adhere to this principle. According to Islam, women have their right to be educated as well as men (El-Azayem and Hedayat-Diba, 1994) and, also, they have the right to work and, actually, are encouraged to do so (Al-Hibri and Habti, 2006). Females education in Saudi Arabia is considered unique among all the world's countries because intermixing of the genders is not allowed within most educational settings. This gender division in education became a topic of studies, research and healthy argument in Saudi society, as it is all over the world. However, this system

remains characterized by the segregation of the sexes, generally, and in higher education institutions in particular.

#### 4.1.6 Historical Background of Distance Education in Saudi Arabia

Distance education originally stems from the events of 1961, when Saudi Arabia introduced a system called *intisab* meaning “external mode of study” in order to allow female students to complete their higher education after having completed their secondary studies, since there were no institutions of higher education for females at that time. This system started with just four external female students enrolled in KSU in 1961. In this system female students did not attend any classes on campus, but attended at the beginning of the semester to collect printed materials for studying and returned at the end of the semester to sit the exams. Between 1979 and 1988, a few women’s colleges were opened, and these continued to provide students with the *intisab* study system, along with campus-based courses. However, over the years, the *intisab* system attracted more female students, and the number reached 414 females students in the College of Arts in Riyadh, and 1068 who enrolled in the College of Arts in Dammam by 1988 (Al-Rawaf and Simmons, 1992). While the government worked to expanded female higher education by opening more girl’s colleges, most of these colleges continue to provide the *intisab* system for female students as a solution for girls who could not enroll in campus courses for many reasons, such as living far away, family conditions, work commitments, or their percentage score in secondary school having fallen below the accepted percentage for acceptance into campus courses. However, the number of female students enrolled in the *intisab* system in girl’s colleges in the Kingdom increased rapidly during the next years, and reached more than 65,000 females enrolling in 70 girl’s colleges in 2004 throughout the Kingdom. In the same year, a Royal Decree announced that all girl’s colleges in the Kingdom would become part of the universities, and that they would be under the supervision of Ministry of Higher Education instead of the General Presidency of Girls Colleges (GPGC). However, most universities in Saudi Arabia continued offering bachelor’s programs through the *intisab* system until recent years where most universities have shifted to providing online distance education courses as an alternative to the *intisab* system with such courses leading to bachelor’s and master’s degrees. Universities have made great efforts in improving these courses by using new distance education technologies and improving the current technologies and seeking advices from the best experts in the field of distance education field nationally and internationally. In general, these courses have been greeted with a warm welcome from

the society and students alike. Although this experiment is still in its beginning stages, it is expected that in time it will continue to improve.

#### 4.1.7 The Importance of Distance Education in Saudi Arabia

During the past 30 years, distance education has been a topic under consideration in Saudi Arabia and many researchers have concluded that there is an urgent need to introduce distance education in Saudi Arabia. Many reasons have been given for this:

- The number of students graduating from secondary schools has increased sevenfold during the past years. Presently, there are approximately 400,000 students who graduate annually from secondary schools, and only 50,000 students get the opportunity to enroll in public universities (Elerini, 2009). However, a few thousand students may choose to study abroad through self-financed studies or on a government funded scholarship through King Abdullah's Foreign Scholarship Program (KAFSP), which gives few thousands of students annually an opportunity to study in some of the world's best universities towards their bachelor's, master's and doctorate degrees. As a result of this situation, approximately 80% of the students stay behind and are unable to continue their further education due to lack of opportunities (Elerini, 2009). This is seen by society as a critical problem and is likely to have a negative impact on the future of the country and its citizens.
- As mentioned earlier in this chapter, geographically, Saudi Arabia is quite large and has several communities that are isolated from the main population hubs. Distance education allows the provision of educational services to isolated areas to curtail disparities across the various regions and areas (AlKhalifa, 2010).
- There is an obvious lack of female faculty members in higher education institutions, where the number of female instructors is too few to cover teaching all subjects to females students in universities. As a solution to this problem, distance education technologies have been utilised to enable male instructors to teach female students in distance-learning classrooms since 1970, because according to the Saudi Arabian education policy, male instructors are not allowed to teach female students face-to-face.
- In 2013, about 25% of the country's budget was assigned to the educational sector as mentioned previously (MOHE, 2013). A large amount of the educational budget is given to universities, many of which have taken the opportunity to improve their

current systems, technologies, infrastructure and to implement new methods of education.

For the above mentioned reasons, all universities in Saudi Arabia began working towards implementing distance education courses and improving the current technologies used in universities in order to achieve their educational objectives.

#### 4.1.8 Saudi's Universities Efforts in Distance Education

In the past few years all Saudi universities have taken important steps in improving their systems and implementing distance education. The most significant effort and current distance education program in Saudi Arabia is outlined below.

As mentioned earlier in this research, one of the most significant uses of distance education in Saudi Arabia is that this system can be used when gender segregation is required in tertiary education. According to the Educational Policy Document in Saudi Arabia, male instructors are only authorized to teach female students by means of CCTV, two-way audio and one-way video conferencing. The CCTV has been used in Saudi Arabia since 1970s for this purpose, and Saudi Arabia was the first country to apply this technology out of the entire Gulf and Arab countries (Almohaissin and Shawat, 2008). During the following years, other technologies have been used in addition to CCTV; such as audio and video conferencing. However, universities have worked hard to update their current technologies, especially in this era that is characterized by such tremendous development in information and communication technologies. In 2003, the Girl's Colleges Agency for Distance Education (GCADE) set up a project for using VSAT technology in female's higher education in Saudi Arabia. In 2006, the VSAT technology has been used successfully to teach more than 300 master's students in 38 girl's colleges throughout Saudi Arabia by broadcasting religious studies, economics and cultural lectures from Riyadh to the colleges. This technique helps hundreds of female students around the country complete their undergraduate and postgraduate degrees, regardless of where they live (Al-Kethery, 2006). It is worth noting that the girl's colleges were the first educational institutions in Saudi Arabia providing distance education through utilizing VSAT technology, and in the two years that followed, some universities also adopted same technology.

In 2004, King Abdulaziz University (KAU) has established the Deanship of Distance Education, which offers distance education program that leads to a bachelor's degree in arts, humanities, economics and administration. It commenced its academic operations in 2007-

2008. The university provided the most advanced technologies to support both the instructor and the learner in the distance education. These technologies included computers, networking, multimedia and the virtual classroom system called Centra. In 2010, the president of KAU launched a new e-learning management system (KAULMS), which was developed and introduced by the KAU Deanship of Distance Education. In the same year, KAU launched its first master's program in distance education in Saudi Arabia (KAU, 2010). Furthermore, KAU provided training courses for its faculty members that were enrolled in distance education courses. It is worth noting that KAU are the permanent headquarters of the Saudi Society for Distance Education (SSDE).

In 2007, Imam Muhammad ben Saud Islamic University in Riyadh, established the Deanship of Distance Education which provide distance learning courses leading to bachelor's degrees to both female and male students in most majors. In these programs, live lectures are transmitted every day through the Internet. In 2008, more than 15,000 students applied to this courses (Imam, 2010).

In 2010, many more universities in Saudi Arabia offered a distance education program leading to bachelor's degree.

## **4.2 Distance-Learning Environment at KSU**

In order to set the context for an evaluation of the educational provision in KSU, this section discusses the details of its synchronous distance-learning environment for teaching female students by male instructors. This discussion includes the classroom's physical design and the physical features of the classrooms. Components of the instructor's studio are also considered in this discussion.

### **4.2.1 Distance-Learning Environment at KSU**

The interactive synchronous distance-learning model used in KSU in Saudi Arabia is illustrated in Figure 4.1. A male instructor is located in a studio at the male campus, Diriyya, while the female students are located in a classroom on the female campus, Mallaz, which is about 19 kilometres away.

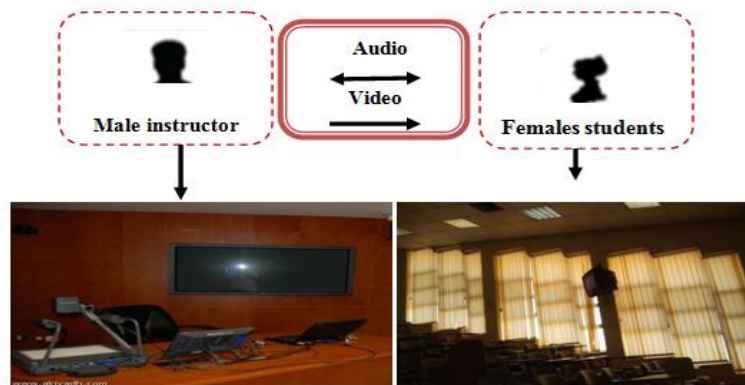


Figure 4.1: Distance-Learning Environment at KSU

Sound transmission between the instructor’s studio and the female students’ classroom is bidirectional; i.e., it is sent and received in both directions. Female students are able to hear, watch, ask and answer questions from their male instructors while males can hear females and create discussions without seeing them.

According to Mervet (2011, personal communication), KSU uses a video conferencing system (Polycom) for distance-learning purposes. This system installed at KSU a few years ago. This system was chosen for its capabilities. This system supports point-to-point communications (connecting two sites, as used in this study) and point-to-multipoint communications (connecting more than two sites). The lectures transfer from the male instructor’s studio in Diriyya to the female students’ classroom in Mallaz through the internal network of KSU.

The audio-visual equipment in the instructor’s studio and the female students’ classroom will be discussed in detail in this section. A simple illustration of how this video conferencing system works is included in Figure 4.2.

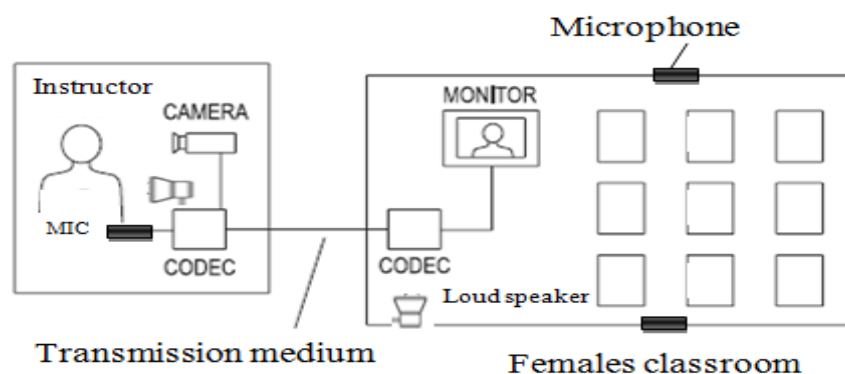


Figure 4.2: Videoconferencing System in KSU

In this system, the male instructor's studio (Figure 4.3) is equipped with the following:



Figure 4.3: Instructor's Studio in KSU

The codec, also known as the coder-decoder, the codec compresses the video and audio signals from the camera and the microphone in the studio. The codec transmits these compressed signals through the network. Then it decompresses the incoming signals so that the video signal can be viewed on a screen and the audio signal can be heard through speakers in the female students' classroom.

A camera equipped with a remote control pan, tilt and zoom (PTZ) feature is aimed at the instructor's face.

A document camera is located on the instructor's desk. It can be used to display documents.

SMART Podium interactive pen display connects to the instructor computer, two large LCD displays. One is in front of the instructor and the other is behind him. A desk-top microphone to pick up the voice of the instructor, two light fixtures and a desk with a chair.

The female students' classroom is also prepared with the proper equipment to receive the broadcast from the male instructor's studio. A detailed description of the content of this classroom is included below.

#### 4.2.2 Arrangement of Classroom Equipment

There are a total of four microphones distributed along the sides of the classroom (two on each side). On each wall, the distance between the two microphones is approximately 6.6 m. When a student wants to ask or answer a question, she needs to push a button on the microphone and speak. The Shure Microphone is used. Along with the microphone, there is also a microphone mixer used to control, balance and combine the signals from the microphones into one audio signal. A Clear One Audio Mixer is used for this purpose.

Along with the microphones, there are four 21-inch Panasonic standard definition televisions distributed along the sides of the classroom (two on each side). Every screen is supported

with built-in loudspeakers to distribute the instructor's voice evenly throughout the classroom. The distance between the two televisions is approximately 5.5 m.

The codec receives the audio signal from the mixer in the female students' classroom and sends it to the male instructor's studio. On the sending end, the codec digitally codes the audio into a digital signal. On the receiving end, the codec decodes the digital signal back into audio.

#### 4.2.3 Physical Features of the Classroom:

The classroom is located on the second floor of the building. It is away from the building entrance/exit and no lifts in the building, just stairs. There is a large square circulation space outside the classroom.

The classroom is rectangularly shaped being 16.3 m. long and a 8.8 m. wide. The ceiling is approximately 4.87 m.-front, 2.7 m.-rear (Figure 4.4).

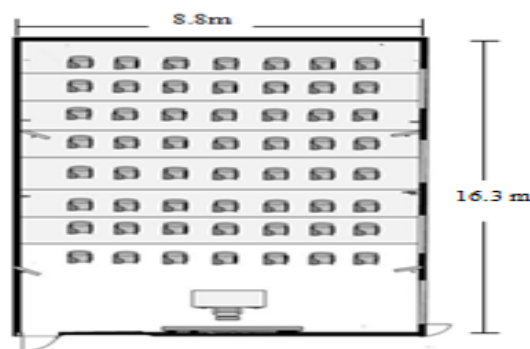


Figure 4.4: Classroom Dimensions

There are 13 aisles in the classroom. Two of them are on the far left and right sides of the room with a width of 1 m. There are 9 horizontal aisles between the seats all of each is approximately 40 cm. width (Figure 4.5), as well as open areas at the front of a room with 3.5 m. width and another open area at the rear of the classroom with about 3.5 m. width (Figure 4.6).

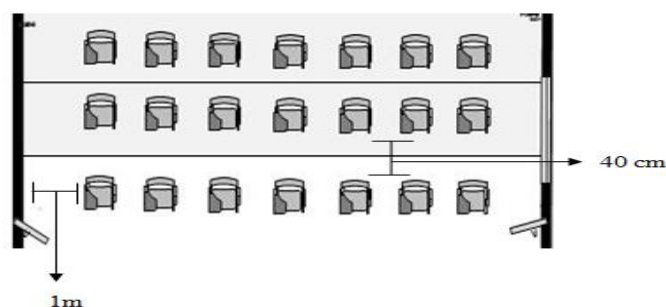


Figure 4.5: Classroom Aisles

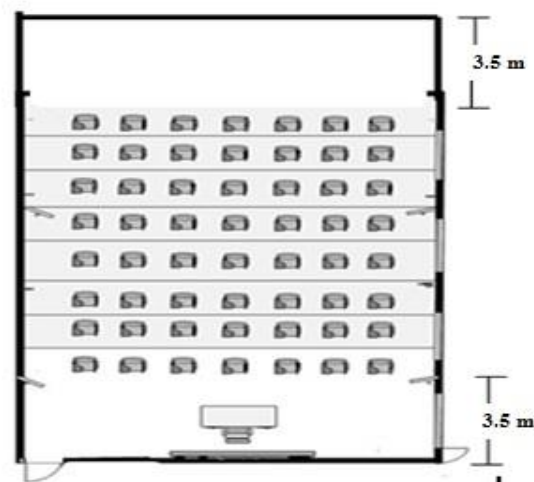


Figure 4.6: Classroom Aisles

The classroom is not prepared to offer easy access for students with disabilities. No lifts lead to the classroom and no stations are provided for those students.

The ceiling of the classroom contains 28 square fluorescent lights, each 60 cm. in width and 60 cm. in length. There are nine square ventilation ducts 50 cm. per side. Additionally, there are four split-type air conditioners on the walls; three are on the rear wall of the classroom and the other one is on the right-side wall above the emergency exit as shown in Figure 4.7.



Figure 4.7 Classroom Ceiling in Distance-learning Classrooms in KSU

The classroom accommodates 110 tablet-arm seats (Figure 4.8) arranged in rows with 10 seats per row. The details of the desk and chair dimensions are shown in Figure 4.9 along with their height from the floor.



Figure 4.8: Tablet-Arm Seat Used in Distance-Learning Classrooms in KSU

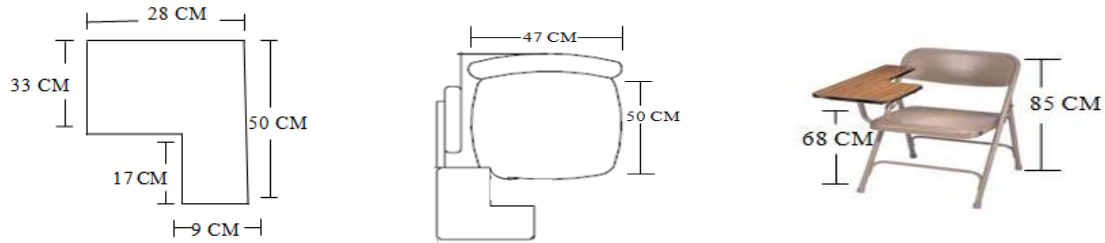


Figure 4.9: Student Desk and Chair

The floor of the classroom is a tiered-floor design with nine tiers made of concrete. Each of these tiers is 1 m. wide and 21 cm. high.

There are nine windows in the classroom; each is 54 cm. wide and 3.18 m. high. Each window is divided into four parts as shown in Figure 4.10. The first three window sections are 54 cm. wide and 76 cm. high; the last window section is 90 cm. high and 54 cm. wide. The second and third windows sections can be opened while the other windows cannot. The windows are covered with white-coloured vertical blinds.

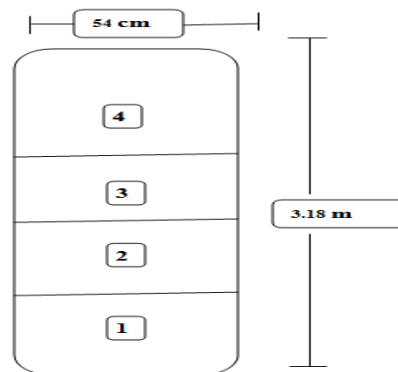


Figure 4.10: Windows Used in Distance-learning Classrooms in KSU

The classroom walls are painted bright yellow. There are two doors in the classroom as shown in Figure 4.11. The first door is the main entrance and the other door is the emergency exit. The main entrance is in the front wall of the room, it is a wooden door approximately 2 m. high and 90 cm. wide. The overall classroom design is shown in Figure 4.12 and Figure 4.13.

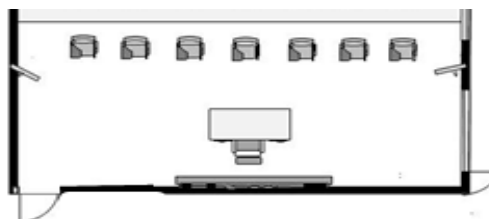


Figure 4.11: Door(s) of the Classroom



Figure 4.12 Distance-learning Classrooms in KSU

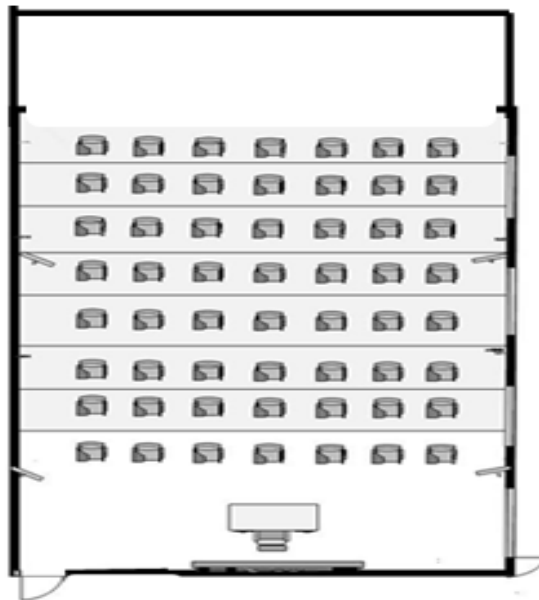


Figure 4.13 Distance-Learning Classrooms in KSU

### 4.3 Summary

This chapter discussed the education of women in Saudi Arabia and the efforts made by Saudi universities regarding distance-learning. It also provided a detailed description of the distance-learning environment at KSU, which is the learning environment to be evaluated in this study. The next chapter will discuss the classroom design.

# 5 Classroom Design

“We know too much about how learning occurs to continue to ignore the ways in which learning spaces are planned, constructed, and maintained ”— Nancy Van Note Chism, Professor, Indiana University-Purdue University Indianapolis.

This chapter discusses the various problems relating to KSU’s distance-learning environment (including the physical design of the classroom, the physical features of the classroom, the technical support in the classroom and classroom management) and reviews the available literature in this regard. This review is used to produce a list of strategies that should be followed for the effective designing of the distance-learning classrooms. These strategies will be coded in the following manner (Str1, Str2, Str3, and so on) throughout this chapter. These strategies will be used later in this thesis to evaluate the distance-learning environment at KSU and to propose solutions for the problems there.

## 5.1 Classroom Physical Design

The physical design of Classrooms, Seminar Rooms, Auditoriums and Laboratories can have a large impact on the teaching-learning process (Lei, 2010). Nowadays, “institutions spend large amounts of scarce funds in order to bring classrooms into the modern century” (Thurnquist, 2009). According to Wulsin (2013), “Well-designed space has the ability to elevate discourse, encourage creativity, and promote collaboration” (p.2). Although there are a large variety of physical designs that can be used to support and facilitate the teaching-learning process, there is no perfect physical design to accommodate all types of academic activity. This topic has attracted educators and researchers in traditional education. All institutions have realised that the quality of the education is largely dependent upon the infrastructure of a well-planned and well-equipped institution and the use of modern methods of teaching and learning. With the evolution of distance-learning technologies, classroom design has also been of interest to distance-learning researchers and educators. For successful and effective distance-learning, it is essential to plan and design a proper classroom. Classroom design for distance-learning is about incorporating the elements of the classroom into an environment that connects students and instructors in a favourable way (Hegarty et al., 1998).

However, there is a lack of published material about classrooms design at KSU. For this reason, many international classroom design guidelines have searched to choose appropriate guidelines that can be incorporated in and applied to the KSU classrooms (See Appendix 5-A). These guidelines are considered as cooperative work and effort by experienced professionals from many well-known international universities worldwide, such as Harvard University, who recognize the crucial design elements of modern, high quality learning environments. Throughout this section and the following sections in this chapter, these guidelines will be discussed in detail. Through such discussion, a list of strategies for effective designing of a distance-learning classroom that use video conferences technology will be produced, and will be numbered in the following manner (Str1, Str2, Str3, and so on) throughout this chapter. These will be used later in this thesis to evaluate the distance-learning classrooms at KSU (See Chapter 4.2) and propose feasible solutions for the problems female students faced there (See Chapter 8). Although the design is a dynamic process and affected largely with any new changes in teaching concepts and technologies etc., the provided strategies in this thesis has been built according to the latest recommendations provided in this regard.

This section discusses the physical design of the classrooms used for distance-learning purposes (i.e. using video conferencing technology). The discussion will include the arrangements of the classroom equipment such as microphones, loudspeakers, display screens etc. It will also discuss technical support in distance-learning classroom. This section starts by providing a general background of the learning room types. These are very important since most of the principles of design differ according to the learning-room type. The classifications mentioned here of the learning room are the same as the classification used at KSU, and will be followed through the thesis.

### 5.1.1 Learning Room Types

Before discussing the physical classroom design, the impact it has on the teaching-learning process and the recommendations provided for effective classroom design, it is important to mention that in most universities the rooms where teaching-learning is conducted are classified by many types. These types have been determined in light of some factors, such as the room size and purpose of the room. One of the most popular classifications used in universities worldwide, is to separate the rooms into six main types: seminar room,

classroom, auditorium room, distance-learning room, service room and laboratory room. The definition of each of these rooms is as follows:

**Auditorium Room:** in most universities the auditorium room is a large room with a seating capacity of 200 or more. These rooms are usually used by many academic disciplines in the university and sometimes it can also serve non-instructional purposes. In most universities, these rooms are typically supported with a multi-media audio-visual system with desks and chairs for students oriented towards the front of the room. The auditorium room should also include seating spaces for wheelchair-bound students and provide easy access for them to use this seating. An example of the auditorium room is shown in Figure 5.1.

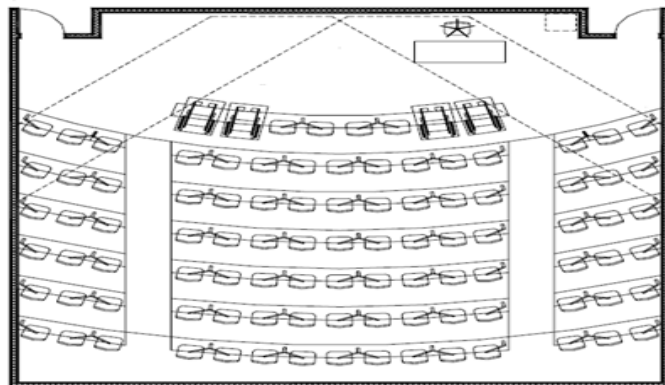


Figure 5.1: Example of Auditorium Room

**Classroom:** in most universities, a classroom is a room used mainly for scheduled classes of many academic departments and accommodated 21 to 199 students. The classroom rarely serves non-instructional purposes. In most universities, classrooms are typically supported with a multi-media audio-visual system with desks and chairs for students oriented towards the front of the room. The classroom should also include seating spaces for wheelchair-bound students and provide easy access for them to use this seating. An example of the classroom is shown in Figure 5.2.

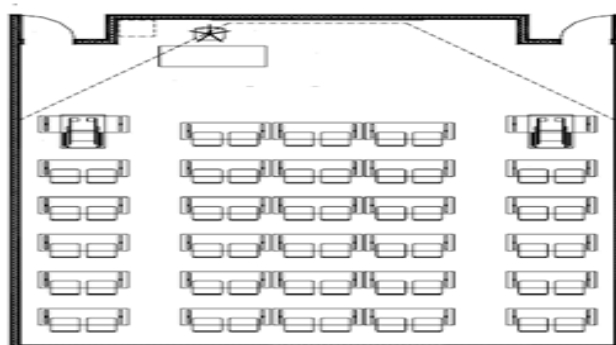


Figure 5.2: Example of the Classroom

**Seminar Room:** in most universities, a seminar room is a room used mainly for scheduled classes of many academic departments and accommodates up to 20 students. Seminar rooms can also be used for non-instructional purposes. In most universities the seminar room is typically supported with a multi-media audio-visual system and a large table surrounded by chairs. The seminar room should also include seating spaces for wheelchair-bound students and provide easy access for them to use this seating. An example of the seminar room is shown in Figure 5.3.

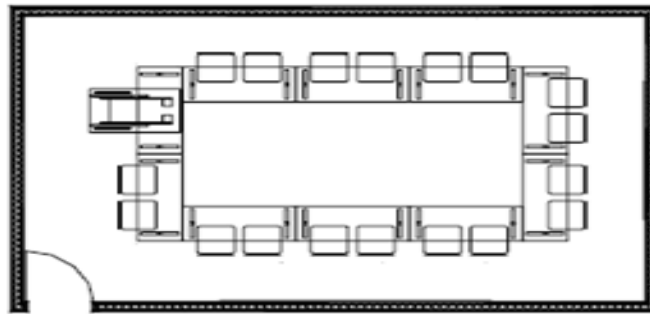


Figure 5.3: Example of Seminar Room

**Distance-Learning Room:** This is a learning room prepared with special audio-visual equipment that allows students and the instructor to communicate orally and visually with each other. Any type of learning room mentioned above can be used as a distance-learning room as long as it is prepared with proper equipment. This equipment mostly are cameras, microphones, loudspeakers and visual display devices such as monitors or large screens. These facilitate interaction and communication between instructors and students who are situated in different places. However, it is worth noting that rooms that are usually used to broadcast to other places and have no students are not classified as a distance-learning room but as media or studio rooms. An example of the distance-learning room is seen in Figure 5.4.

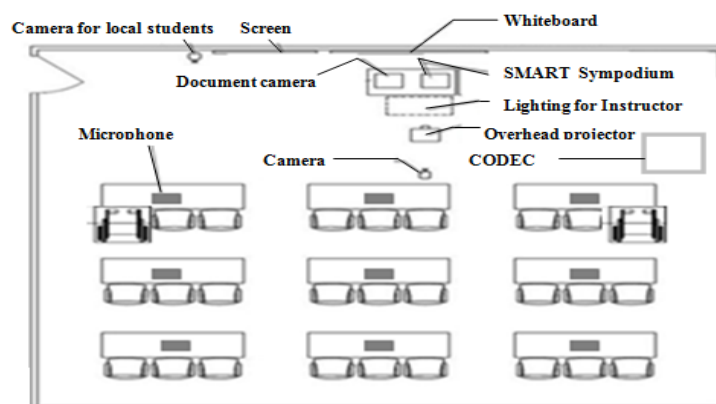


Figure 5.4: Example of Distance-learning Room

This distance-learning room should be prepared with the proper equipment that will enable instructors and students in the classroom to interact with the remote classroom. This equipment includes:

- CODEC: the codec compresses the video and audio signals from the camera and the microphone in the classroom. The codec transmits these compressed signals through the transmission medium, and then it decompresses the incoming signals so that the video signal can be viewed on a screen and the audio signal can be heard through loud speakers in the remote classroom.
- SMART Symposium: The Symposium is an interactive screen that allows the instructor to draw over computer applications with the stylus, while continuing to face the students.
- Lighting above the instructor's desk.
- Two cameras – one aimed at the instructor's face and the other aimed at the students in the classroom.
- A document camera located on the instructor's desk. This allows the instructor to display documents to the students. Features such as Freeze, Zoom, and Rotate are usually included in the document camera.
- Microphones for both the instructor and the students.
- Overhead projector, screen and electronic whiteboard.

**Service Room:** a room that serves directly all other room types as an expansion of the activities in those rooms. Examples include projection rooms and storage rooms.

**Instructional Laboratory Room:** a room consisting of special-purpose tools and equipment that aid the process of experimentation, study, participation, and practice by students within a given field of study. Within a majority of universities, laboratories are prepared with the purpose of serving subject-specific requirements. Examples include chemistry instruction lab, physics instruction lab and computer instruction lab (See Figure 5.5).

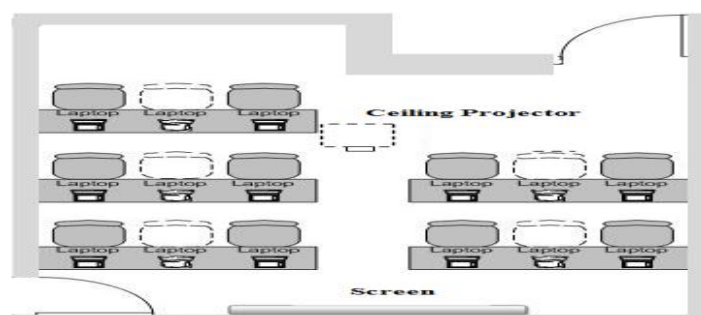


Figure 5.5: Example of Computer Instruction Lab

As this thesis concentrates on the distance-learning rooms, and these rooms can be a seminar, classroom or auditorium, these three types will be considered in the discussion when required, other types of learning rooms are beyond the scope of this thesis. However, there are many recommendations and guidelines provided in terms of designing the distance-learning room such as, equipment arrangements, seating arrangements, and physical features. According to Thurnquist (2009), although most of the criteria used in the design of traditional learning rooms applies directly to the design of the distance-learning room, there are also some specific criteria which apply only to the design of distance-learning rooms. In this thesis the term 'classroom' will be used to refer to all types of the learning rooms for simplicity. However, clarification will be provided when required.

### 5.1.2 Definition of Classroom Design

Design is defined as “a plan or drawing produced to show the look and function or workings of a building, garment, or other object before it is made” (Oxford Dictionary, 2012). According to Houston (2001), the definition of classroom design is the process of “...Conceiving and selecting the structure, elements, arrangement, and materials that make up or are enclosed by a classroom - also, the plan or layout that results” (p.100). Dickens and Tanza (2000) have stated that classroom design includes a large number of variables (lighting, equipment, temperature, and furniture, etc), that should be arranged appropriately to help meet the educational goals. Rao and Dietrich (1996) contend that the design of a classroom is reflected in various aspects, such as physical layout, technological support, and classroom environment. According to Armstrong et al. (1998) the learning environment is the cornerstone of education and is reflected in the design and the overall layout of the classroom. It is important to consider and meet the requirements of students and instructors while designing a classroom rather than merely replicating the design of prior projects or compromising on the design in ways that might adversely affect the quality of the learning environment. Clabaugh (2004, p.1) stated that:

“Students have a fundamental right to a classroom learning environment that allows them to see anything presented visually, to hear any audible presentation free from other noises and distortions, and to be physically comfortable (lighting, temperature, furniture, etc.) regardless of the method of instruction”

Every and Walborn (1999) have also confirmed that good design should be accomplished for the simple reason that students deserve the best learning environment.

### 5.1.3 Importance of Classroom Design

According to Lackney (1999) the physical design of a room affects its occupants and can either motivate or discourage them. According to Niemeyer (2003), the arrangement of the classroom components such as furniture and equipment must be carefully determined in order to motivate both instructors and students, and to support the teaching-learning process. For the students, a well-designed classroom has many advantages, such as increasing student interest in learning, improve student performance, encouraging teamwork, and increasing participation in the classroom (Wulsin, 2013). If the classroom design is beyond students' expectation, students will feel helpless and hopeless (Veltri et al., 2006). Furthermore, it has been proposed that there is a direct link between classroom physical design and student learning (Lei, 2010) and according to Hawkins (1997), "good classroom design improves learning" (p.1). This has also been confirmed by Moore (1997) who confirmed the significant role of classroom design in improving both student learning and experience in the classroom. According to Knowles (1993), all classroom components, such as physical features and furniture arrangements, can have a large impact on students' experience. Earthman (2013) has asserted that educational facilities in the classroom must be planned in a way that enhances students' learning and performance. In distance learning, classroom design can also affect student learning and, according to Gregg and Persichitte (1992), classroom design should be a primary consideration for distance-learning planners to create an effective distance-learning environment. A distance-learning classroom encompasses the virtual presence of the instructor and the students, so it is important to design the classroom in such a way that both the instructor and the students feel each other's presence. When students feel connected to each other they discuss and interact freely which creates an environment conducive to knowledge sharing and healthy learning. Dickens and Tanza (2000) have confirmed that designing a space for teaching or learning in distance-learning requires careful planning, preparation and organisation. However, designing a distance-learning classroom is similar to some extent with the design of a traditional classroom with adding special audio-visual and communications equipment enables the instructor and students to communicate visually and orally with each other. The distance-learning classroom is made up of three main parts: the classroom itself with its physical features (lighting, temperature, ventilation etc.),

the arrangement of the classroom equipment (microphone, camera, audio speaker etc.) and a transmission medium.

#### 5.1.4 Arrangement of Classroom Equipment

Clabaugh (2004) advises that the classroom's equipment, intended for the delivery of instructional materials to distance learners, be designed and arranged with adequate care. The arrangement of such equipment plays a vital role in the communication process between students and instructors. According to Jenkins (2004), students and instructors must be able to see and hear each other clearly so that non-verbal cues such as facial expression and other body language is clear as they carry significant components of communication. According to Earthman (2013) the classroom equipment should be designed and arranged in such a way that helps to enhance students' learning, experiences and performance. So it is important to take care of general classroom features such as space, ventilation and lighting, etc. and incorporate them with classroom equipment such as microphones, audio speakers, screens in such a way as to turn the typical classroom into a distance-learning classroom. The arrangement of distance-learning classroom equipment includes both audio and video equipment will be discussed below.

**Audio and video Equipment Arrangements:** high quality audio and video reception in the distance-learning classroom is essential in order to enable the students and the instructor to communicate effectively, and to understand each other. Poor sound or picture quality will negatively affect the students' understanding during lectures and may also lead to many other problems such as a reduction in their level of interest and participation in the lectures. However, the type of audio and video equipment needed depends upon many variables such as classroom size, its capacity, the institution's budget, the subjects being taught etc. These issues will be discussed in this section.

In terms of the audio equipment arrangements in the distance-learning classroom, most audio systems in a distance-learning classroom include fundamental pieces of audio equipment, including one or more microphones with a mixer for controlling, balancing and combining the signals from these microphones, and a number of loudspeakers for audio distribution throughout the classroom.

Microphones should be designed carefully for the distance-learning classroom. Problems related to microphones such as using inappropriate number of microphones, inappropriate locations of these microphones or insufficient working status can affect students' learning

and hinder the communication between students and instructors in the distance-learning classroom. Such problems have been highlighted and discussed by many researchers. In KSU, problems related to microphones used in the distance-learning classroom have been considered by few researchers. Al-Aboudi (2008) reported that the number of microphones in the classroom is insufficient when compared to the number of students in the classroom; four microphones for a classroom that can accommodate about a hundred female students. She added that the fact that these microphones are placed on walls of the classroom may lead to problems in accessing those microphones. In addition to that, some of these microphones are old and do not work properly, and there is a lack of technical assistance. Furthermore, sometimes the crowded nature of the classroom can cause difficulty in students' movements and being able to reach the microphones, this will also negatively affect the level of student participation and their engagement in the classroom. Therefore, when choosing and designing microphones in the distance-learning classroom, many important considerations should be considered as discussed below.

Microphones and similar input devices are designed to pick up the user's voice. Commercially, there are many types of microphones that can be used for a number of applications, including distance-learning purposes. Both researchers and companies have provided multiple guidelines for designing audio equipment in the distance-learning classroom, the types of microphones that can be used, with the advantages and disadvantages of each, as well as how users can choose from the options according to their own requirements. Researchers such as Giddings (1995), Portway and Lane (1997), Richardson (1998), Lyons et al. (2008), McCarthy (2010), Laughlin (2011) and Lichtman and Hellard (2011) have provided guidelines regarding the designing of microphones that can be used in teleconferencing and distance-learning classrooms. Furthermore, microphone companies such as the Shure Incorporated Company and Crown Audio Company have also provided many guidelines in this regard. Examples of these guidelines are given in Appendix 5-B.

Analysing these guidelines has resulted in many important considerations and strategies that help to design effective audio systems in the distance-learning classroom as will be discussed below:

Researchers have reported that one of the most significant factors in designing the audio systems in a distance-learning classroom is by considering the distance between the microphones and the students (Hegarty et al., 1998). When the microphone is placed at a greater distance from the student, the magnitude of sound reaching the microphone is

reduced, therefore the sensitivity of microphone to sound should be amplified in order to compensate. Although, in this way, microphone will catch more desired sound it will unfortunately also catch unwanted sounds such as background noise, echoes, and sound repetition from the loudspeaker etc. The greater the distance between the microphone and the student, the greater are the problems with audio quality.

It is recommended by many researchers that there should be a specific distance between microphones and students. It is argued that a hollow sound will result beyond this particular distance regardless of the type of microphone or how it is directed or positioned. This particular distance is referred as the Critical Distance. The quality of the audio is based on the Critical Distance. The Critical Distance must be less than 2 ft for the ideal situation in distance-learning classroom. If the distance is in range of 2 to 3 feet, is still good and acceptable but a distance greater than 3 ft is considered unacceptable. This leads to the first strategy (Str1) for the effective designing of the distance-learning classrooms (See Appendix 5-C).

Before choosing a type of microphone, it is important to evaluate them and consider their advantages and disadvantages to determine which one is most appropriate for the users' requirements. For example, before using the desk-top-microphone in distance-learning room, it should be take into account that these microphones are sensitive and they pick up ambient noise, such as paper shuffling; so, if it is likely that students will be shuffling books and papers on their desks during the class session, the microphone might pick up muffled sounds or rustling noises. Therefore, a gooseneck (lectern) microphone (Figure 5.6) is recommended because it elevates the sensitive part of the microphone above the surface of the desk, closer to the speaker and further from the noise. This leads to the Str2 and Str3 for the effective designing of the distance-learning classrooms (See Appendix 5-C).



Figure 5.6: Example of a Gooseneck (Lectern) Microphone

It is recommended also to avoid omni-directional microphones and use unidirectional microphones, especially hyper-cardioid microphones, because these microphones are designed to be more sensitive to sounds coming from one direction and they have also been designed to rejected sound-related problems such as feedback, background noise and

reverberation. This leads to the Str4, Str5 and Str6 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

Only one microphone should be active at a time. This can be achieved manually by using a switchable microphone so each student can turn his/her microphone on and off. However, some researchers have noted that this type of microphone may not be user-friendly because it requires an action on the part of the students (i.e. they must switch it on or off). An alternative and a more effective solution is to use an automatic microphone mixer. This leads to the Str7 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

If the classroom only includes chairs and no desks, the lectern microphone should be mounted onto the seat backs, or a hanging microphone should be used, instead, which is better for sound quality. This leads to the Str8 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

It is also recommended that, in a distance-learning room, the best and ideal arrangement of microphones is to allow one microphone for each student and these should be placed at arm's length from each student. However, this is not always possible, due to many factors such as the institution's budget; therefore, two to three students per microphone is adequate. This leads to the Str9 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

According to many researchers, if the microphones cannot be placed on student desks for any reason, there are some other places possible, such as suspending the microphones from the ceiling. However, ceiling microphones are not recommended by researchers for the following reasons:

- The ceiling microphone is usually more than 2 ft from the speaker, which makes the voice sound hollow and distant.
- Classroom ceilings almost include many types of equipment that produce noise, such as air ventilation systems. This will definitely affect the quality of the audio pickup by the microphones.
- Students almost do not look toward the ceiling when they speak; if anything, they look down at their desks when they speak.

However, if the microphone is hung from the ceiling, it should be combined with excellent room acoustics as will be discussed later in this chapter. This leads to the Str10 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

Additionally, because the microphone is considered to be the one piece of equipment that is particularly vulnerable to problems (Garrison, 1990; Price, 1991), it is important that microphones be properly maintained and checked regularly. In fact, it is recommended that microphones used in distance-learning classroom be checked once a week to ensure good sound quality and to verify that they are in good working order. This leads to the Str11 for the effective designing of the distance-learning classrooms (See Appendix 5-C). In summary, for effective design of microphones in distance-learning rooms, it is important to take into account all the above-mentioned strategies.

In terms of the instructor’s microphone, if the instructor is likely to move around while talking, a lavalier microphone is recommended for easy movement and better sound quality. This microphone should be placed on the instructor’s shirt, about 8 inches below the chin. If the instructor is likely to sit in front of a desk during the lecture, then a desk-top microphone is recommended. That microphone should be placed less than 2 ft. from the instructor.

In addition to the microphones, the visual display devices in the learning room, such as projection screens or televisions, are other important components that should be designed carefully. All types of learning rooms should have a projection screen with appropriate dimensions to allow students in all seats to see the image without discomfort or image distortion. Although it is common to use a front projection (Figure 5.7) in all learning room types, it is recommended to avoid the front projection in the distance-learning room and use either rear projection (Figure 5.8) or flat panels (such as LCD).

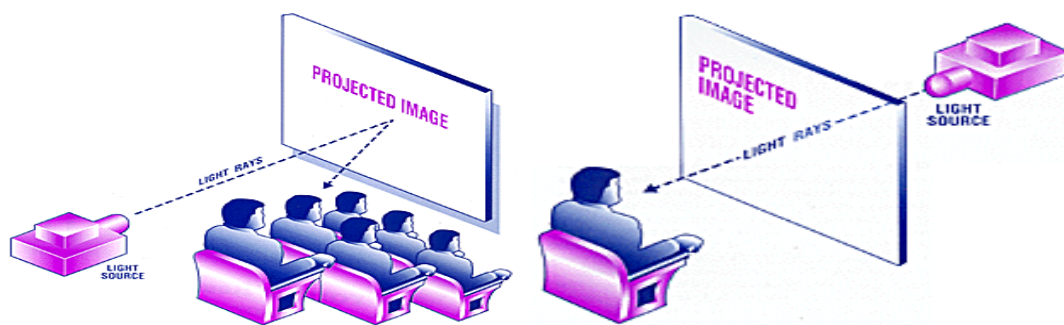


Figure 5.7: Front Projection

Figure 5.8: Rear Projection

In designing the projection screens in the learning room, many issues should be considered, such as its location, number, size and its display resolution.

In terms of the number of projection screens, one is enough for seminar rooms containing up to 20 students. This leads to the Str12 for the effective designing of the distance-learning classrooms (See Appendix 5-C). In a classroom and auditorium, two projection screens at

least are required. This leads to the Str13 and Str14 for the effective designing of the distance-learning classrooms (See Appendix 5-C). The same recommendations are applied when using LCD televisions.

The appropriate size of the projection screens can be determined as following: the minimum height of screen is 20% of the distance to the seat farthest from the screen. The minimum width for the screen can be determined by using the aspect ratio. The aspect ratio is the ratio of the width of the image to the height. For (CRT) technology, the aspect ratio is 4:3. For high definition technology, the aspect ratio is 16:9. For example, if the classroom includes a CRT technology and 18 ft is the distance to the farthest seat from screen, the minimum height of the projection screen should be 3.6 ft ( $20 \times 18 / 100$ ) and by using the aspect ratio the minimum width is 4.8 ft. For HD technology the nominal dimensions will be 3.6 ft high and 6.4 ft wide. This leads to the Str15 and Str16 for the effective designing of the distance-learning classrooms (See Appendix 5-C). However, as distance-learning rooms mostly include televisions instead of projection screens (as in KSU), Lei (2010) has recommended that the size of the televisions in the distance-learning classroom can be determined as following: one inch for each foot of distance between the farthest student and the television; e.g. a room where the farthest student is 20 feet from the screen requires a screen size of at least 20 inches. This leads to the Str17 for the effective designing of the distance-learning classrooms (See Appendix 5-C). However, using a larger screen size is recommended to allow students to be more comfortable and feel more in touch with the instructor. This leads to the Str18 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

With regards to the locations of the projections screens, they should be distributed in a way that allows every student in every seat to see the entire image easily without discomfort or image distortion. According to Clabaugh (2004) “the top of the screen should be no greater than 35 degrees from the horizontal from any seating position” (p.21) (Figure 5.9). This leads to the Str19 for the effective designing of the distance-learning classrooms (See Appendix 5-C). In addition to that, “the centre of the screen should be no greater than 45 degrees from the vertical from any seating position” (Clabaugh, 2004, p. 21) (Figure 5.10). This leads to the Str20 and Str16 for the effective designing of the distance-learning classrooms (See Appendix 5-C). The bottom of the screen should be placed at least 6 feet from the floor. This leads to the Str21 for the effective designing of the distance-learning classrooms (See Appendix 5-C). In addition to that, the minimum distance between projection screens at the

front of the room and closest seats should be no less than 9 feet in all room types. This leads to the Str22 for the effective designing of the distance-learning classrooms (See Appendix 5-C). The same recommendations are applied to televisions in distance-learning classrooms.

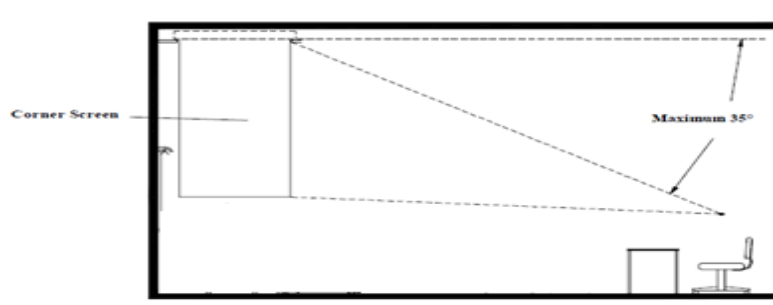


Figure 5.9: Screen Location According to Viewing Angles

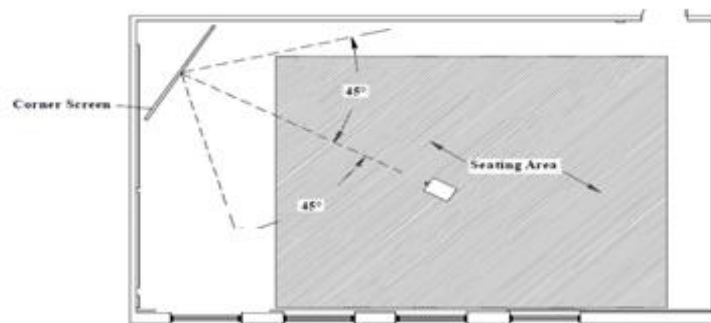


Figure 5.10: Screen Location According to Viewing Angles

The quality of the image display is very significant in a distance-learning because this feature is very important in the transfer of non-verbal communication such as gestures, since these are considered to be an important element of a successful teaching-learning process. The quality of the image display is determined by the display resolution. According to Rizvi (2011), the display resolution of a television is “the number of distinct pixels in each dimension that can be displayed. It is usually quoted as width × height, with the units in pixels” (p.414).

Significant advancements have been made in terms of image resolution in new generation TVs. Standard definition televisions have been replaced almost completely with more advanced TV generations such as enhanced-definition televisions and high-definitions televisions, which have been launched everywhere in the market over the past few years. In addition, today’s latest generation of televisions, the ultra-high definition TVs might replace all previous generations. Therefore, it is recommended that the televisions for the distance-learning classrooms should incorporate the most advanced and up-to-date technology

available. This leads to the Str23 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

As is the case with microphones, loudspeakers must be designed carefully in the learning room. It is recommended that a classroom with 85 students or larger, and auditoriums, should have voice amplification systems. This leads to the Str24 for the effective designing of the distance-learning classrooms (See Appendix 5-C). In designing the loudspeakers in the classroom, a number of important factors should be considered such as the type of loudspeaker, the number of loudspeakers, and their location. Richardson (1998) pointed out that choosing an adequate number of loudspeakers in the learning rooms is a very important part of the design process. For example, if a single loudspeaker is used for a large auditorium, this can lead to many problems including:

- The audio must be extremely elevated. This will increase the likelihood of feedback and distortion of the sound.
- The students who are positioned at a distance from the loudspeaker will have difficulty in hearing what's going on, while those in direct proximity could be overwhelmed by the sound level.

Therefore, using an appropriate number of loudspeakers will help to keep the volume at an acceptable level throughout the classroom, and will minimize sound-related problems. This can be achieved through considering a number of factors as discussed below:

When choosing the type of loudspeakers, it is recommended to chose loudspeakers that have a uniform response throughout the entire range of speech frequencies. The loudspeakers should radiate sound uniformly over a wide coverage angle; a coverage angle of 140o or more is ideal (Figure 5.11). This leads to the Str25 and Str26 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

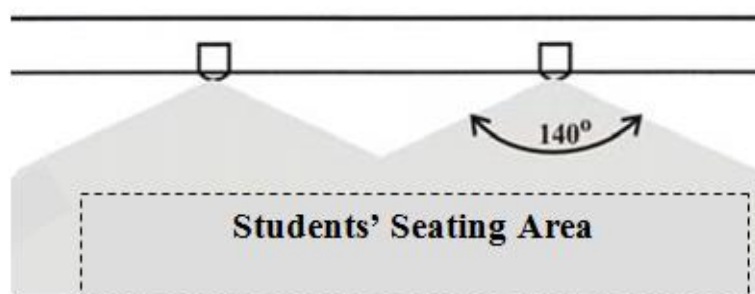


Figure 5.11: Good Coverage Angle

It is also important to consider the loudspeaker-to-student distance; the recommendation is to keep an appropriate distance between all students and the loudspeakers. This can be achieved through calculating the Distance Ratio [the distance from the loudspeaker to the most distant student against the distance from the loudspeaker to the closest student]. A Distance Ratio of approximately 2:1, or less, is excellent. Distance Ratios in excess of 3:1 should be avoided. This leads to the Str27 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

Use the Distance Ratio and the covering angle, as mentioned above, will lead to determine the adequate number of loudspeakers, as well as their arrangement (example of a good number and arrangement of ceiling-mounted loudspeakers is illustrated in Figures 5.12 and 5.13).

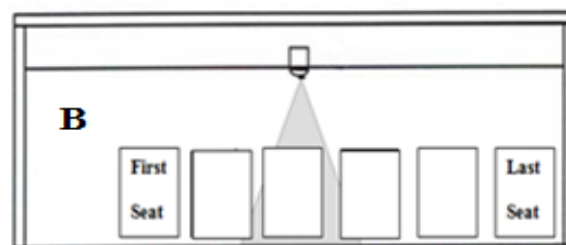


Figure 5.12: Poor Design (Narrow Coverage Angle and Excessive Distance Ratio)

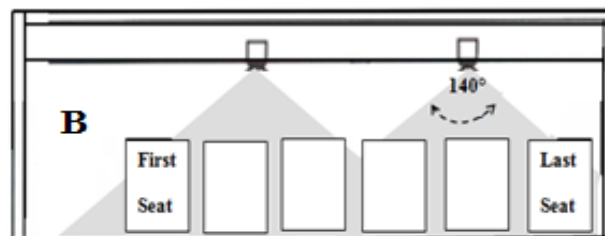


Figure 5.13: Good Design (Wide Coverage Angle and Good Distance Ratio).

In terms of the location of the loudspeakers, the most common way to distribute them in the classroom is to locate them in the ceiling (or mount them along the walls), and to manage each of them with a separate power amplifier. The location should also be as far as possible from any microphones to avoid creating feedback/squealing (See Acoustics of the learning-room section later in this chapter). It is also preferable to place loudspeakers behind the directional microphones for better sound quality in the classroom. This leads to the Str28, Str29 and Str30 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

As mentioned previously, sound quality and clarity is the key to effective communication in distance-learning classrooms (Clabaugh, 2004). According to Clabaugh (2004), most audio problems in a distance-learning classroom are caused by poor acoustics in the room. For this reason, advanced acoustic systems are necessary as part of distance-learning because, without proper acoustics, audio equipment such as microphones and loudspeakers can have noise problems which can obstruct the message and harm the quality of the audio within the classroom (Støfringsdal, 2010). Studies have shown that classrooms with poor acoustics can lead to many problems such as affecting students' participation in the classroom, affecting their interest in learning, and leading to lower test scores (Dockrell and Shield, 2006). Furthermore, Gregg and Persichitte (1992) have stated that one of the major barriers facing students in a distance-learning situation involves sound-related problems, since the quality of sound sometimes fails to meet students' expectations, and is affected by other equipment in the classroom such as air conditioners which could hamper the quality of the audio output. Therefore, it is important to consider and solve all sound-related problems in the distance-learning classroom. This can be done by many ways, for example:

- Through the use of intelligent infrastructure that can suppress echoes and can also shield the classroom from external noises (e.g. from outside air conditioning, ventilation, etc);
- Through the use equipment that either does not make a noise at all, or makes such a low noise that it does not disturb the students or hinder the hearing process;
- Through the use of special equipment such as an Acoustic Echo Canceller that can eliminate some sound-related problems.

However, all sound-related problems with its solutions will be discussed later in this chapter (See Acoustics of the Learning Room Later in this Chapter).

The camera arrangement in broadcasting studios, where the instructor is located plays an important role in the teaching-learning process in distance-learning. Properly installed cameras, good lighting and appropriate seating can play a very important part in this process. It is recommended that the studio should include one or more HD cameras pointed at the instructor's face. It is also recommended to have a document camera for the materials being presented by instructors. This leads to the Str31 for the effective designing of the distance-learning classrooms (See Appendix 5-C). The cameras should be installed in places where the viewing angles are appropriate, so that the transferred images are as natural as possible. This leads to the Str32 for the effective designing of the distance-learning classrooms (See

Appendix 5-C). The viewing angles must be strictly considered before installing the cameras. The lighting should also be in accordance with the requirements of the studio: ceiling lights should be bright and angled to provide good detail in instructor's face and avoid dark shadows, especially under the eyes. This leads to the Str33 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

However, the camera arrangements are not the only important aspect; the instructor's ability to deal with the camera and teaching through it must also be considered. The instructor must familiarize himself with the studio features and cameras and allow himself time to practice this way of teaching before starting the course. He should also remain in direct contact with a studio professional for help. According to Rao and Dietrich (1996), the instructor should learn to look at the camera instead of looking at a monitor in front of him. In addition, instructors should be aware that teaching through a studio is different from the traditional classroom and introduces many special needs and challenges, especially in the case of this study where the instructor is teaching female students without seeing them.

To sum up, all the above-mentioned strategies should be followed for the effective design of the equipment in the distance-learning classroom.

## **5.2 Classroom Physical Features**

Researchers have asserted that the physical features of the classroom are very important to the overall classroom climate and they affect the learning experience of students (Griffin, 1990; Banning, 1993; Troup, 2000; Hill and Epps, 2010). Banning (1993) states that the physical features of a classroom have a large impact on the teaching-learning process and these features also affect other components of the learning environment such as interaction in the classroom. According to Thurnquist (2009), an "inside out" approach is better for designing a really good learning-room. The "outside in" or the traditional approach—designing the room first, and then determining what fits inside it—is not a preferable approach because it may lead to many problems. However, it may be difficult for professionals to resolve some problems later including: poor sight lines, congested spaces and inefficient seating arrangements. In distance-learning rooms, students and instructors should be able to see and hear each other and be comfortable communicating with each other. Aspects of the classroom such as noise, either internal or external, may affect this communication and hinder the teaching-learning process. The classroom's physical features include many components: room location, access, size, shape, noise level and acoustics, lighting, student

desks and chairs, windows, temperature and ventilation (Lei, 2010). It is worth noting that most design recommendations used to determine the physical features of a traditional learning-room (seminar, classroom and auditorium) are mostly applied directly to distance-learning rooms. According to Lee and Forde (2002), traditional learning rooms can be used as distance-learning rooms as long as the acoustics, lighting and other requirements are met. However, there are a few exceptions and some specific additional requirements added to distance-learning rooms. These issues will be discussed in this section. However, as mentioned early in this chapter, due to the lack of research into the physical features of classrooms in KSU and in Saudi Arabia, the same international guidelines (Appendix 5-A) will be used in this section. It is worth mentioning that some of the physical features, such as ceiling and flooring, is depended on the building code of the country, the architectural decisions in the institutions and other factors. However, all strategies provided in this thesis are reported by many international professionals as the preferable design for the learning environment that can be used in any country.

#### 5.2.1 Location of the Learning Room

It is advisable to locate learning rooms no more than one floor up or one floor below the entrance/exit of buildings to ensure ease of access. This leads to the Str34 for the effective designing of the distance-learning classrooms (See Appendix 5-C). However, if classrooms are located on upper floors of the building, this should be combined with excellent access for students including students who use wheelchairs (e.g. provide proper size lifts). It is also recommended to locate learning rooms away from all sources of noise, whether it is external or internal such as lifts, stairs, machine rooms and so forth. This leads to the Str35 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Additionally, the circulation space outside the learning room should be large enough to facilitate students' movements and accommodate the number of students waiting for the next class. It is recommended that corridor capacity be equal to the occupancy of classrooms served by these corridors and is preferable to provide at least 3 sq. ft. per student. This leads to the Str36 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Furthermore, when choosing the location of the learning room, it is important to evaluate this location in relation to natural light. However, this location should be evaluated differently according to the purpose of the learning room. If the room will be used for traditional teaching-learning, it is preferable to allow natural day light to enter. However, this is not the situation in distance-learning rooms which should be designed to prevent, or minimize, natural light from entering

the room. The same recommendations mentioned above are applied to the distance-learning room.

### 5.2.2 Size of the Learning Room

The room size has a significant impact on the arrangement of audio-visual equipment in the room, seating arrangements, sight lines, acoustics and the interaction between instructors and students. Thurnquist et al. (2009) stress on the importance of having a learning space that is large enough to accommodate the planned number of students for different types of learning rooms along with the audio-visual equipment and furniture. Although it is difficult to determine the optimal size for a learning room, the general recommendation is to size the room, especially seminar rooms, in a 2:3 or 3:4 width to length ratio. This leads to the Str37 for the effective designing of the distance-learning classrooms (See Appendix 5-C). However, for the classroom and auditorium room, it is preferable to design the room with a length dimension of approximately 1.5-2 times the width. This leads to the Str38 for the effective designing of the distance-learning classrooms (See Appendix 5-C). With regard to distance-learning rooms, additional spaces are required to accommodate the equipment and provide adequate camera angles. According to Clabaugh (2004, p.44):

“From 30-40% additional square footage may be needed in distance-learning rooms to accommodate additional equipment and provide adequate work space for the instructor and students”

This leads to the Str39 for the effective designing of the distance-learning classrooms (See Appendix 5-C). However, Lee (2002) has recommended the size of a distance-learning room should be no less than 20 ft. (width) and 30 ft. (length) to accommodate the audio-visual equipment as well as the students and instructor.

### 5.2.3 Shape of the Learning Room

In terms of shape, learning room should be designed so that all students have good viewing angles. This leads to the Str40 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Learning rooms should not be too wide (Figure 5.14) or too deep (Figure 5.15) because they may have poor sight lines and hinder eye contact between students and instructors. This applies to both classrooms and auditoriums. This leads to the Str41 for the effective designing of the distance-learning classrooms (See Appendix 5-C). For a

seminar room, long and narrow shapes (Figure 5.16) are not recommended because this design makes it difficult for students and instructors to see each other. Additionally, some students will find it difficult to see the items written on the whiteboards. This leads to the Str42 for the effective designing of the distance-learning classrooms (See Appendix 5-C). According to Thurnquist (2009, p.8):

“To support interactive discussion while providing good sight lines in the classroom and seminar room, rooms that are nearly square (Figure 5.17) are preferable, for a large auditorium- over 200 students- rooms that have a fan-shaped or shape based on ‘viewing angles’ from projection screens (Figure 5.18) almost work out best”

This leads to the Str43 and Str44 for the effective designing of the distance-learning classrooms (See Appendix 5-C). For the distance-learning room, it has been recommended that rectangular shapes (Figure 5.19) are more appropriate for proper sight lines and acoustics than are square shapes (Lee, 2002; Gregg and Persichitte, 1992). This leads to the Str45 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

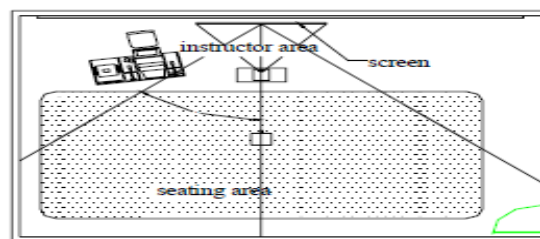


Figure 5.14: An Example of a Room that is Too Wide.

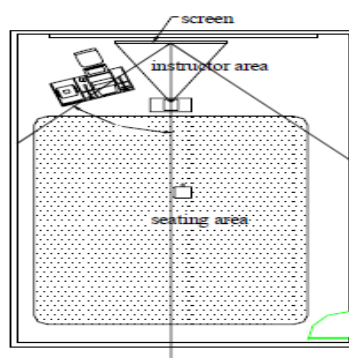


Figure 5.15: An Example of a Room that is Too Deep

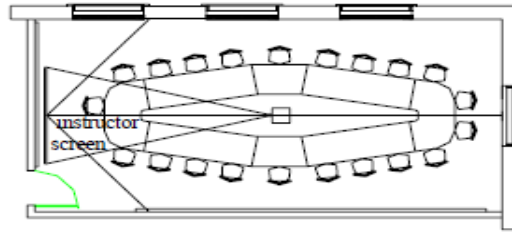


Figure 5.16: An Example of Long and Rectangular Shapes Seminar Room

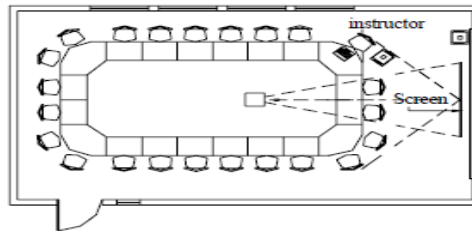


Figure 5.17: An Example of Acceptable Seminar Room

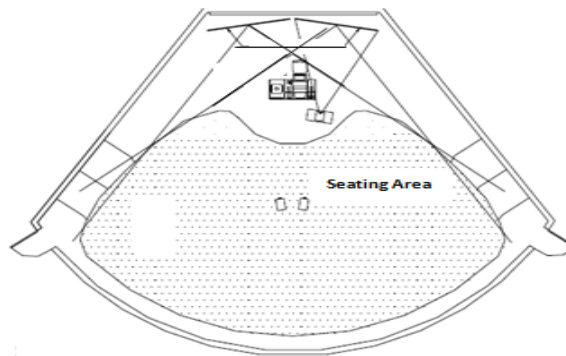


Figure 5.18: An Example Fan-Shaped Learning Room

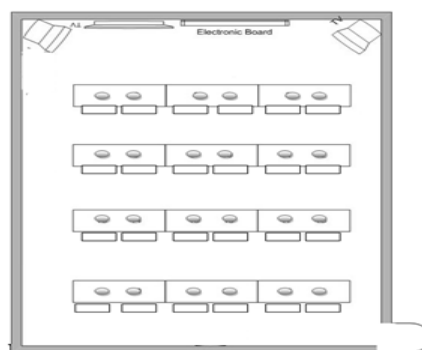


Figure 5.19: An Example of Acceptable Distance-learning Room Shape

#### 5.2.4 Door(s) of the Learning Room

It is recommended that a learning room have an adequate number of door(s) to facilitate students' movements when entering and leaving the room. Clabaugh (2004) states that one door is enough for a seminar room and classroom of up to 85 students. This leads to the Str46

for the effective designing of the distance-learning classrooms (See Appendix 5-C). For larger classrooms (above 85) and auditorium, it is preferred to have two doors as this will be beneficial in facilitating students' movements and accommodating movements of classroom equipment into and out of the room. This leads to the Str47 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

Many designers and researchers recommended that the door be located either at the side or rear of the learning room, especially in distance-learning rooms. This would help latecomers enter and get a seat without disturbing the work of the rest of the class. This leads to the Str48 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

It is recommended that the width of a door should be at least 3 ft. while the height should be at least 7 ft.. This leads to the Str49 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Door(s) should be located in a way that the hallway must not get crowded by students, especially during a change of classes. It is recommended that doors open into the learning room instead of the hallway. This leads to the Str50 for the effective designing of the distance-learning classrooms (See Appendix 5-C). However, if it is indispensable for the door to open outside, the opening space of the door should be clearly marked. A sign should be hung to warn the students or floor tiles can be rearranged in a manner to indicate the extent to which the door will open. It is possible that in the absence of a warning sign, students or another passerby may get hurt by the sudden opening of the door. This leads to the Str51 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Moreover, doors should have bolts attached to them to keep them open in order to avoid congestion at peak times. This leads to the Str52 for the effective designing of the distance-learning classrooms (See Appendix 5-C). The entrance alcove for doors of auditorium rooms must have enough space for students to stand till they are called in. In designing alcoves for auditoriums, noise reduction and restriction of light entry should be the primary consideration. This leads to the Str53 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

It is advisable to attach vision panels at eye level on doors which should be made of shatter-resistant glass. This leads to the Str54 for the effective designing of the distance-learning classrooms (See Appendix 5-C). The area of door used for a vision panel should be a minimum of 2 sq. ft. and needs to be tinted for limiting the spread of light. This leads to the Str55 for the effective designing of the distance-learning classrooms (See Appendix 5-C). If vision panels were not used then the provision of glass sidelights alongside doors are

recommended. Sidelights are preferred to be either full height or start 3 ft above the floor level to be accessible for wheelchair users, as well as, for student who are standing. This leads to the Str56 for the effective designing of the distance-learning classrooms (See Appendix 5-C). However, both vision panels and sidelights must be placed so that outside light will not affect projection screens in the learning room. This leads to the Str57 for the effective designing of the distance-learning classrooms (See Appendix 5-C). All learning room doors should have lever handles (Figure 5.20) (not door knobs as shown in Figure 5.21) for easier use by students with disabilities. This leads to the Str58 for the effective designing of the distance-learning classrooms (See Appendix 5-C).



Figure 5.20: Door Lever Handles



Figure 5.21: Door Knobs Handles

In addition, it is preferable to use an additional electric-powered door opener for easier access of students with disabilities. This leads to the Str59 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Furthermore, if locks are used on the doors, it is prefer to be deadbolt locks that are card-activated. This leads to the Str60 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

According to Clabaugh (2004) “Doors should also be equipped with hardware that results in a slow and quiet closure to a tight sound seal when fully closed” (p.6). This leads to the Str61 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Doors with ventilation louvers are not recommended since such doors will allow outside noise to disturb the classroom environment. This leads to the Str62 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Placement of kick plates on the outer side of doors helps to prevent their scratching and protects them from collisions. This leads to the Str63 for the effective designing of the distance-learning classrooms (See Appendix 5-C). According to Myrick (1999), every room has to be numbered to make it easy for students and instructors to identify. This leads to the Str64 for the effective designing of the distance-learning classrooms (See Appendix 5-C). In term of distance-learning rooms, the same recommendations should be applied. Additionally, Gregg and Persichitte (1992) have recommended that when a classroom contains a camera, the door(s) should be outside the

camera’s viewing range. This leads to the Str65 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

### 5.2.5 Ceiling of the Learning Room

The ceiling is one of the critical components in the learning room that largely affects many other components, such as the acoustics and noise level within the room. Many characteristics of the ceiling should be considered, such as height and surface cover. Many factors affect the decisions regarding the ceiling height in the classroom and these might differ from one institution to another and from one country to another. In general, according to many international guidelines, the minimum ceiling height can be determined as presented in Table 5.1.

<b>Number of students in the classroom</b>	<b>Minimum Ceiling Height (ft.)</b>
<b>Seminar room with flat floor (20 student)</b>	8
<b>Classroom with flat floor (21 to 85)</b>	9 but 13 is preferable
<b>Classroom with tiered or sloped floor (86-149)</b>	13 front, 9 minimum-rear
<b>Classroom with tiered or sloped floor (150- 199)</b>	15 front, 9 minimum-rear
<b>Auditorium with tiered or sloped floor (200- 299)</b>	15 front, 9 minimum-rear
<b>Auditorium with tiered or sloped floor (above 300)</b>	18 front, 9 minimum-rear

Table 5.1: Minimum Ceiling Height in the Learning Room

The abovementioned guidelines lead to the Str66 to Str70 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

With regard to the surface of the ceiling, it is recommended that ceilings in all learning rooms and more specifically in distance-learning rooms be covered with sound-absorbing acoustical tiles, Noise Reducing Coefficient (NRC) between .65 and .85 should be met, because they will have a large impact in reducing reflections and other sound-related problems, as will be discussed later in acoustics. This leads to the Str71 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Furthermore, other specifications such as moisture resistant, optimum hygiene, fire protection and aesthetics etc. should also be taken into

account in designing the ceiling. This leads to the Str72 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

#### 5.2.6 Floor of the Learning Room

In both the seminar room and the classroom of up to 85 students, it is recommended to use a flat floor in the seating area and instructor area (Clabaugh, 2004). This leads to the Str73 for the effective designing of the distance-learning classrooms (See Appendix 5-C). The flat floor will be more appropriate and flexible in this case to support different activities in the classroom, such as group discussions, as it is easy to change the layout of the classroom. It is also advisable to avoid adding raised platforms in front of the room because this will create access problems for students in wheelchairs. This leads to the Str74 for the effective designing of the distance-learning classrooms (See Appendix 5-C). In terms of larger classrooms and the auditorium, it is common to use either a sloped or tiered floor because it provides good sight lines to projections screens. This leads to the Str75 for the effective designing of the distance-learning classrooms (See Appendix 5-C). However, if a sloped or tiered floor is used in the learning room, it is recommended to have an appropriate-sized, at least 9-10 ft. width, flat area in front of the room to provide easy access for students in wheelchairs. This leads to the Str76 for the effective designing of the distance-learning classrooms (See Appendix 5-C). It is also recommended that the room entrances should be barrier-free to allow easy access for wheelchair students and allow free movement of equipment carts. This leads to the Str77 for the effective designing of the distance-learning classrooms (See Appendix 5-C). The same recommendations are applied in case of the distance-learning room. With regard to the floor covering, the type used in a seminar room, auditorium and classroom is generally specified by the architect, based on aesthetic goals, maintenance requirements and many other conditions (Jester and Morgans, 1997). However, some institutions prefer that the flooring of the learning rooms be covered with vinyl composition tiles or rubber tiles. Such materials are characterised by many advantages, such as reasonable cost, easy maintenance and a livelier look than a carpet. This leads to the Str78 for the effective designing of the distance-learning classrooms (See Appendix 5-C). However, many other institutions prefer the industrial-grade, stain-resistant carpet to be used in the learning rooms, especially in distance-learning room. This leads to the Str79 for the effective designing of the distance-learning classrooms (See Appendix 5-C). This material offers many advantages. For example, it provides valuable acoustical features to the room,

which are especially important in distance-learning rooms. It is also very durable and as easy to maintain as vinyl floors (Allen et al. 1996). However, in cases where movable seating is being considered for the room, some researchers advise weighing the acoustical features of the carpet against the maintenance expenses that result from the wear and tear caused by the movement of the furniture. Gregg and Persichitte (1992) state that the carpeted floor should be smooth and free of wiring and cords to facilitate students' movements in the room. This leads to the Str80 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

In terms of the colour of the carpet, if it is plain and too dark, it will quickly look dirty. This leads to the Str81 for the effective designing of the distance-learning classrooms (See Appendix 5-C). So, Allen et al. (1996) emphasise that the floor covering should be of a medium to light colour, such as Beige, and recommend some type of subdued pattern or fleck to make it less likely to look dirty and break the monotony. This leads to the Str82 for the effective designing of the distance-learning classrooms (See Appendix 5-C). It is further recommended to have a four-inch to six-inch cove installed around all the walls of the room. This leads to the Str83 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

#### 5.2.7 Walls of the Learning Room

The learning-room walls should be designed with Sound Transmission Class (STC) ratings that can efficiently decrease or block intruding noise. The STC rating is a numeric rating of how well a building partition attenuates airborne sound. An STC rating of 50 for Walls, floors and ceiling is recommended by many researchers. This leads to the Str84 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Furthermore, all walls should extend to the floor above or to the roof construction, rather than stop at the ceiling. This leads to the Str85 for the effective designing of the distance-learning classrooms (See Appendix 5-C). This is very important in reducing the level of noise in the classroom and improving security. However, if the classroom is near noise-generating locations, such as elevators, mechanical rooms, music rooms, etc., then special wall-construction details and a higher STC rating are required. This leads to the Str86 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Additionally, it is possible to use concrete masonry units as structural walls, provided that they are covered with additional finishings, to ensure good acoustics. This is particularly important in cases of distance learning rooms. This

leads to the Str87 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

#### 5.2.8 Colours/ Finishes in the learning room

The colour of the surfaces of the learning room is an important feature which should be considered and chosen carefully. Such decisions usually depend on many factors and are made through the work of many professionals such as colour consultants, architects, environmental graphic designers and interior designers etc. However, some general recommendations will be provided in this regard. All finishes of materials used in the learning room should be durable, easily cleaned and maintained. This leads to the Str88 for the effective designing of the distance-learning classrooms (See Appendix 5-C). It is preferred that walls are painted in a light colour in all learning room types except the distance-learning room. This leads to the Str89 for the effective designing of the distance-learning classrooms (See Appendix 5-C). It is further advised that the walls behind the projection screens must be coloured darker compared to other areas. This helps in reducing light reflection when media projection are being used. This leads to the Str90 for the effective designing of the distance-learning classrooms (See Appendix 5-C). For the colour of furnishing and the audio-visual components, these should be coordinated with finish colours of the classroom, building and university campus. However, it is advised to use neutral colours for furniture and audio-visual equipment to make it easy to move it from one learning room to another. This leads to the Str91 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

In a distance-learning room, the materials and finishes for surfaces in the classroom (such as paints on walls, vinyl coverings on the floor and furniture should be video-friendly to avoid more effects and reflective glare. Furthermore, the use of very neutral colours is recommended for wall finishes and furniture. Blue and grey colours are much preferred for walls and camera background areas to enhance video and image quality. This leads to the Str92 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

#### 5.2.9 Windows in the Learning Room

Windows are among the critical components in the learning room that should be evaluated in the early stages of the design process. Windows can affect many other components of the learning environment, such as acoustics of the classroom, ventilation, viewing capability of

the screens, etc. Therefore, many factors should be considered in this regard, such as the size of the windows, their location and cover.

According to Thurnquist (2009), when determining the location of the learning room, its relation to natural light should be taken into account, and windows should face a direction that makes it easy to control light in the classroom and provide adequate blackout capability. This leads to the Str93 for the effective designing of the distance-learning classrooms (See Appendix 5-C). In addition, windows should be located away from walls that are near noisy yards, exhaust fans, pedestrian walkways and building cooling towers (Clabaugh, 2004). This leads to the Str94 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Furthermore, all windows should be at the sides of the room and not located in the front or rear of the room. This leads to the Str95 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Clabaugh (2004) says that there are two main purposes of windows in the learning room, aesthetic and environmental. Allen et al. (1996) state that the presence of windows in the traditional learning room is important in creating visual contact with and sensory stimulation from the world outside. Windows can also be opened to provide additional air circulation in the classroom when required or closed to eliminate noise from exterior sources. As Clabaugh (2004, p.24) affirms:

“All windows should be operable so that they can be opened to provide additional air circulation when needed, particularly when the building heating, ventilating and air conditioning system is not operating adequately”

This leads to the Str96 for the effective designing of the distance-learning classrooms (See Appendix 5-C). It is also recommended that windows should open outward but not inward. This leads to the Str97 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Furthermore, the glass surfaces of windows should be limited to minimum amounts. This leads to the Str98 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

Many researchers and guidelines on designing distance-learning rooms recommend against the presence of the windows in the classroom (Gedemer, 2011). Windowless classrooms have many advantages, such as the ease of light control, the removal of heat loss or gain in times of extreme temperatures, and the removal of noise interference from outside sources (Clabaugh, 2004). This leads to the Str99 for the effective designing of the distance-learning classrooms (See Appendix 5-C). However, if the classroom does not have windows, it should

include a good air-conditioning and ventilation system. If the distance-learning room has windows, it is recommended that these windows have suitable covers that can be controlled as required. These days, many types of room darkening roller shades, such as Draper Dual Roller Flexshade, are recommended by researchers, due to their advantages in controlling the amount of light entering the room according to the purpose of the room. This leads to the Str100 for the effective designing of the distance-learning classrooms (See Appendix 5-C). This will prevent all outside light from reaching the TV screens, as well as, providing a high level of noise block. The sheer curtains and standard vertical or horizontal blinds fail to shield the room from unwanted light and sounds and therefore should be avoided. This leads to the Str101 for the effective designing of the distance-learning classrooms (See Appendix 5-C). The window coverings can be manually operable if windows are accessible, if not, coverings should be motorized with controls located in accessible location (e.g. at the instructor's workstation). This leads to the Str102 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

#### 5.2.10 Student's Desks and Chairs in the Classroom

According to Cohen and Caster (2000), students should have comfortable seats to facilitate their sitting and movement. In the arrangement of seats, student comfort and preferences should be the primary considerations, not only the technological requirements. Thurnquist (2009) indicate that careful designing creates successful learning rooms where the type and size of the room and location of furnishings are comfortable and flexible to accommodate students of different sizes and needs. Selection of desks and seats can vary according to the type of learning room but in all room types it is important to ensure that all students have good sight lines to projection screens when determining the furniture type and the seating arrangements of the classroom. This leads to the Str103 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

In terms of the seminar room, it is preferable to use either movable tables and chairs or one fixed table (square-shaped, circle-shaped, boat-shaped, etc.) and movable seats. Using one fixed table and movable seats can help improve eye contact between students on both sides of the table and will be more appropriate for some activities, such as group meetings. This leads to the Str104 for the effective designing of the distance-learning classrooms (See Appendix 5-C). It is also recommended to provide 25 to 27 sq. ft. for each student in the seminar room.

This leads to the Str105 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

With regard to the classroom, assigning individual tables with movable chairs is recommended in classroom of up to 50 students. The students will then be able to move easily, as instructed by their instructor, for different in-class activities. As such, it will allow flexibility to return to routine positions when needed. This leads to the Str106 for the effective designing of the distance-learning classrooms (See Appendix 5-C). It is recommended to provide 20 to 22 sq. ft. for each student in such classroom. This leads to the Str107 for the effective designing of the distance-learning classrooms (See Appendix 5-C). In larger classroom, 51 to 199 students, it is recommended to “use continuous fixed work surfaces, and upholstered movable chairs with adjustable-height seats and backs” (Thurnquist, 2009, p.17). This leads to the Str108 for the effective designing of the distance-learning classrooms (See Appendix 5-B). It is recommended to provide 18 to 20 sq. ft. for each student in such classrooms. This leads to the Str109 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

In terms of the auditorium (200-399 students), it is recommended also to be designed with “continuous fixed work surfaces, and upholstered movable chairs with adjustable-height seats and backs” (Thurnquist, 2009, p.17). This leads to the Str110 for the effective designing of the distance-learning classrooms (See Appendix 5-C). It is recommended to provide 16 to 18 sq. ft. for each student in such an auditorium. This leads to the Str111 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

However, in bigger auditoriums where large numbers (more than 400) of students have to be accommodated, seats with tablet arms are advised to reduce room depth and costs. This leads to the Str112 for the effective designing of the distance-learning classrooms (See Appendix 5-C). It is recommended to provide 14 -16 sq. ft. for each student in such an auditorium. This leads to the Str113 for the effective designing of the distance-learning classrooms (See Appendix 5-C). In addition, it is preferable that seating in a 200+-capacity auditorium be arranged in a gentle arc or U-shape to provide good sight lines to all screens, and allow students to communicate more easily with each other and with the instructor. This leads to the Str114 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Moreover, it is important that seating arrangements in all room types ensure that all students have good sight lines to screens, as discussed before.

In terms of the size of students' work surfaces and its height in each type of learning room, it is preferable to comply with the following guidelines:

In general, the work surfaces should provide each student with at least 4 sq. ft. of usable space in one unobstructed area. This leads to the Str115 for the effective designing of the distance-learning classrooms (See Appendix 5-C). The minimum dimensions of the work surfaces for each student according to the type of learning room are shown in Table 5.2. This leads to the Str116 to Str118 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

In terms of the height of the work surfaces, it is essential to "allow unobstructed knee clearance space underneath work surfaces that is at least 22 inches wide and 27 inches high" (Thurnquist, 2009, p.25). This leads to the Str119 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Furthermore, all work surfaces in the classroom should be designed to accommodate right and left-handed students. This leads to the Str120 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

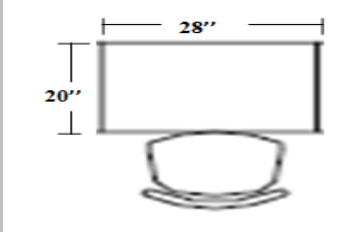
<b>Type of learning room</b>	<b>Work surface minimum dimensions</b>
<b>Seminar room with movable desks, Seminar room with fixed table and classroom with movable desks</b>	20 inches deep and 28 inches wide. 
<b>Classroom and auditorium with continuous work surfaces</b>	18 inches deep and 28 to 30 inches wide.

Table 5.2 Minimum Dimensions of Work Surfaces in the Learning Room

Wheelchair-bound students must be given important consideration and provided with appropriately sized workstations at least 36 inches wide. This leads to the Str121 for the effective designing of the distance-learning classrooms (See Appendix 5-C). It is recommended to have at least 2 workstations for wheelchair students in the learning room. This leads to the Str122 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

In terms of students' seats, it is recommended that students are provided with comfortable seats that offer them excellent ergonomics. This leads to the Str123 for the effective designing of the distance-learning classrooms (See Appendix 5-C). It is also recommended to avoid armrests by using armless task chairs. This leads to the Str124 for the effective designing of the distance-learning classrooms (See Appendix 5-C). With regards to seat spacing, a minimum of 28" on centre is required in the learning room with movable desks or with continues work surfaces (Figure 5.22 and Figure 5.23). This leads to the Str125 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

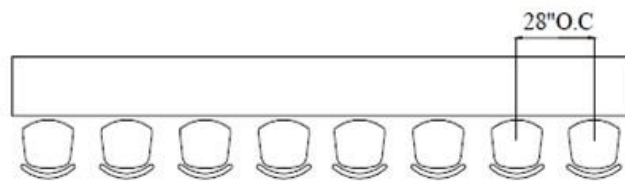


Figure 5.22: Seat Spacing for Continuous Work surfaces

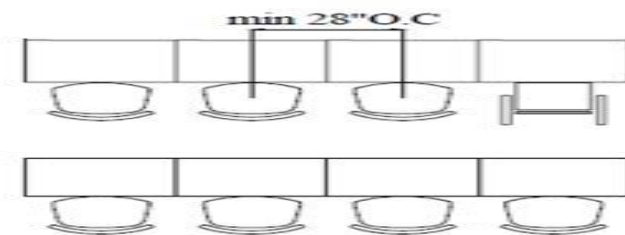


Figure 5.23: Seat Spacing for Movable Desks

For the large auditoriums with tablet-arm seats: seats spacing should be a minimum of 24 inches on centre (Figure 5.24). This leads to the Str126 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

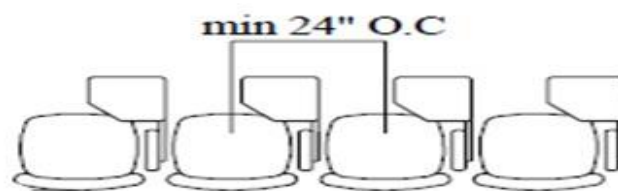


Figure 5.24: Seats Spacing for Tablet-Arm Seats

The same guidelines should be followed in designing students' desks and chairs in a distance-learning room.

### 5.2.11 Aisles in the Learning Room

In terms of the aisles within the room, it is recommended that the aisles should provide easy access for students' seating. This will be beneficial in the classroom when students enter the

classroom late as they can sit easily and quickly and this will reduce level of noise. According to Clabaugh (2004) “aisles must be sufficiently wide enough to allow wheelchairs to pass easily” (p.11). For all types of learning rooms with any dimensions, all main aisles leading to the instructor’s area and to the door should have a width of at least 36 inches (Figure 5.25). This leads to the Str127 for the effective designing of the distance-learning classrooms (See Appendix 5-C). It is also recommended that aisles behind seats in use should have a width of at least 15 inches (Figure 5.25). This leads to the Str128 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

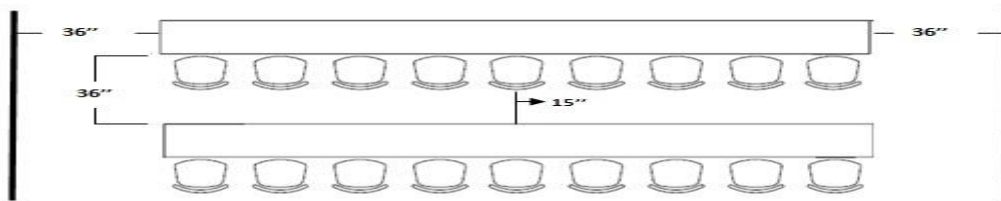


Figure 5.25: Aisle Width in the Learning Room

It is also recommended that the area in front of the room and including the instructor area should have a width of at least 9 ft. from the front wall of the room to the first row of seats (Figure 5.26). This leads to the Str129 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

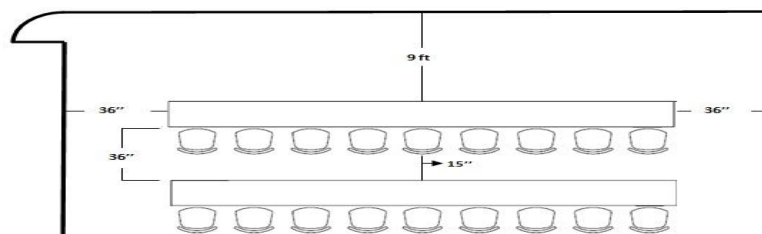


Figure 5.26: The Width of the Area at the Front of the Learning Room

Following the above mentioned recommendations it will be advantageous in the sense that students in wheelchairs could easily reach their seats and late comers could enter without disturbing others.

### 5.2.12 Lighting of the Learning Room

There is a significant amount of literature concerning lighting in the classroom, from daylight to artificial lighting (Earthman, 2013). Hawkins (1997) argued that levels of lighting in the classroom affect both the psychological and physiological status of students. Winterbottom, and Wilkins (2009) stated that poor classroom lighting can distort colour and may resulting in

depression and headaches for students. Knez (1995) has shown that classroom lighting conditions affect student performance either positively or negatively. Boyce et al. (2003) suggested that classroom lighting can contribute positively to improve the look and feel of students' living space. However, despite the importance of lighting in the classroom, it has been reported that it remains one of the common problems in classrooms (Cohen and Caster 2000). The lighting and electrical power systems should be designed to be energy-efficient and should be easy to maintain and modify. This leads to the Str130 and Str131 for the effective designing of the distance-learning classrooms (See Appendix 5-C). In the distance-learning room, lighting is an important feature that should be taken into account when designing the classroom. The lighting should be controlled, easy to use and safe. Allen et al. (1996) recommended that lighting switches should be labelled clearly according to their function. This leads to the Str132 for the effective designing of the distance-learning classrooms (See Appendix 5-C). It is also recommended to use indirect or parabolic fluorescent lights and avoid locating lights behind the instructor area. This leads to the Str133 and Str134 for the effective designing of the distance-learning classrooms (See Appendix 5-C). It is preferable also to use lighting controls that automatically turn off lights in unoccupied rooms. This leads to the Str135 for the effective designing of the distance-learning classrooms (See Appendix 5-C). For the distance-learning classrooms, Jones and Michael (2000) say that for the best viewing of TV screens in the classroom, natural light from windows should be avoided and normal artificial light or a slightly dimmed room is recommended. This leads to the Str136 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Cybela (1997) suggested that room lighting should be also monitored to accommodate TV viewing and other activities in the classroom. Cameras require light to capture images and normal room lighting is suitable for this: horizontal lighting is best for cameras, while overhead lighting is best for students. This leads to the Str137 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Researchers have also recommended that lighting in distance-learning room should be carefully controlled to avoid shadows and reflections. They have also recommended that the level of lighting should be minimized as much as possible to be 50 foot-candles on horizontal surfaces and 35 foot-candles on vertical surfaces. This leads to the Str138 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Finally, the lighting system (especially the fluorescent light fixtures) should be checked regularly by an

electrician. This leads to the Str139 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

#### 5.2.13 Heating, Ventilation and Air Conditioner (HVAC) in the Learning Room

There is a considerable amount of literature about the temperature, ventilation and air conditioner of the learning room. Earthman (2013) stressed the importance of temperature, heating and ventilation on student achievement. Fisher (2001) mentioned that these elements are likely to affect student behaviour and outcomes. However, unsuitable temperatures and poor ventilation are common problems in traditional educational classrooms. These problems are likely to exacerbated in distance education classroom as many equipments is used, and such equipment can increase the classroom temperature. Therefore, maintaining a comfortable room temperature and good ventilation are essential elements in distance education environments (Cybela, 1997). Because the distance-learning classrooms use technology, proper ventilation and air conditioning facilities are needed to protect the instruments from overheating and to avoid increase in the classroom temperature. This leads to the Str140 for the effective designing of the distance-learning classrooms (See Appendix 5-C). It is recommended that the Air Conditioning should be a year-round type. This leads to the Str141 for the effective designing of the distance-learning classrooms (See Appendix 5-C). It is recommended that noise-controlled (HVAC) systems should be selected in the initial design of the classroom, as this will have a large impact on the reduction and elimination of noise especially in distance-learning rooms. This leads to the Str142 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

#### 5.2.14 Level of Noise and Acoustics in a Room

There is a large amount of literature studying the effect of noise on human functioning, a considerable part of it concentrating on learning in noisy environments. Many researchers have concluded that the level of noise and the acoustics in a room are important factors in the overall classroom environment, and influence the performance and activity of students (Edmonds and Smith, 1984; Fisher, 2001; Schneider, 2002; Earthman, 2013). According to Shure (2007), the quality of the acoustics in a learning room are determined by physical characteristics such as the size, shape and materials used in construction, and covering the surfaces of the room, such as walls, ceiling and floor. Schneider (2002) has reported that “good acoustics are fundamental to good academic performance” (p.6). While this element is

very important in traditional classrooms, it is even more important in distance-learning rooms. It has been reported that most sound problems in distance-learning rooms are caused by poor acoustics in those rooms (Shure, 2007).

Crandell et al. (2004) highlight the factors that affect acoustics in the room. These include reverberation of sounds from surfaces, the level of background noise and the distance between the speakers and the listeners. These, among other factors, will be discussed below.

Smaldino et al. (2005) define reverberation as the reflection of sound waves from solid surfaces, instead of the sound directly heard by the audience from the speaker's mouth. A room is said to be highly reverberant if it has lots of solid surfaces, such as Walls, floors, ceilings, windows and tables arranged in parallel. Sound waves will reflect off of hard surfaces before decaying beyond the students' ability to hear it. This reverberation of sound is also termed as the 'bouncing effect', which refers to an obvious hollowness in sound, which causes students to hear the echoes of their voices when they speak. Another word used to describe this phenomenon is 'multipath' (Figure 5.27).

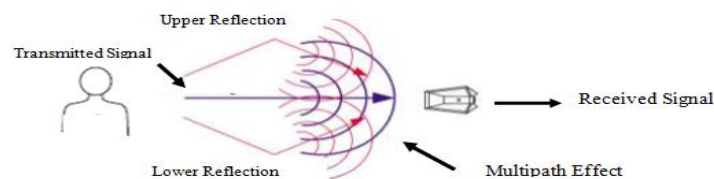


Figure 5.27: Multipath Effect

Reverberation time (RT) is the measure of reverberation. Crandell et al. (2004) define reverberation time as the time required by a sound signal to fall to 60 decibels (dB) from its initial level. According to Anderson (2004), a longer reverberation time negatively impacts the ability to perceive the spoken word. Smaldino et al. (2005) say that for a student to adequately comprehend the instructor's speech, the RT in the room should not exceed one second.

Knecht et al. (2002) and Seep et al. (2000) cite many research studies claiming that the usual reverberation time (RT) in many traditional classrooms exceeds the recommended limit of 1.0 second. However, an RT of up to 1.2 seconds is still acceptable. This leads to the Str143 for the effective designing of the distance-learning classrooms (See Appendix 5-C). In the case of a distance-learning room, it is recommended that the RT value not exceed 0.6 seconds. However, researchers have reported that this Figure is difficult to achieve in practice, so an RT ranging from 0.6 to 0.75 seconds is still considered perfect for distance-learning rooms. This leads to the Str144 for the effective designing of the distance-learning

classrooms (See Appendix 5-C). A higher RT value will have a negative impact on the clarity of sound in the classrooms. Although the reduction of reverberation is necessary in traditional classrooms, the need increases greatly in the case of distance-learning rooms.

Higher reverberation levels will hinder the ability of the listener to clearly understand the spoken language. Facing such a situation, students will find it difficult to properly hear the words of their instructors, their fellow students, or audio presentations. However, reverberation is not much of a problem in traditional classrooms, mainly because students can ignore the bouncing effect of sound, concentrating their minds and ears on hearing their instructors, peers and other sound media presentations. In other words, they hear three-dimensionally. However, the situation is not that easy in distance-learning rooms where hearing is one-dimensional; a microphone simply picks up everything it ‘hears’ and sends it to the other classrooms. Distinguished between the original sound and the reflected sound is not possible for the microphone, and all sound is given the same treatment. Students in distance-learning rooms cannot benefit from the three dimensions of hearing because sound signals reach them from only one source (the loudspeaker). Eventually, it is not only the original voice that reaches the listeners in distance-learning locations but also added reflections, causing students to hear at one level (the volume of loudspeakers), that produce a distorted, garbled sound. Despite the voices sounding sufficiently good, it is possible for reverberant rooms to create deep rumbles that might be audible across other distance-learning rooms (Figure 5.28).

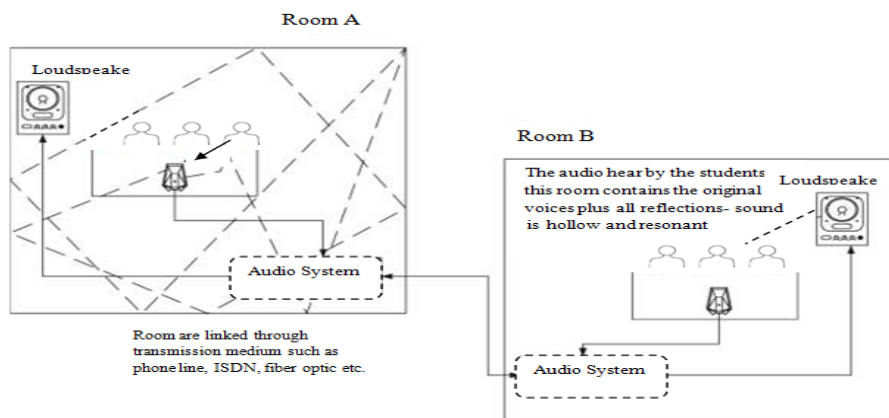


Figure 5.28: Reverberation in the Classroom

There are a number of remedies available to control the reverberation in distance-learning rooms. The best way is to give acoustic treatment to the whole internal structure of the room.

Under the acoustic treatment plan, the ceiling should be covered with acoustic tiles, the floors carpeted, and curtains drawn over the windows. Some electronic remedies are also available:

1. All idle microphones have to be turned off by using an automatic microphone mixer that works by reducing the number of sound reflections. The mixer will turn on automatically once the sound reflection level is above the set threshold. An additional benefit of the automatic mixer is that it helps reduce background noise.
2. Microphone processors can discern patterns of voice to separate the original voice from a mix of reflected sounds. These processors prevent the reflections from being transmitted further and thus retain only original sound in the system. However, one processor is required for each microphone. These devices are useful in removing the background noise from the transmitted audio.
3. The rumble in highly reverberant rooms can be effectively removed by using background noise cancellers. The rumble would still be there in the room but would not be heard over the audio transmissions. However, the problem of background noise is discussed below in detail.

Background noise is another important factor that can affect the quality of sound in the classroom and interfere with students' ability to listen and clearly understand what they hear. According to an A-weighted scale, which is a measurement based on human hearing capabilities, the overall noise level in empty room should be 30 to 35dB as this standard is acceptable internationally for both traditional and distance-learning rooms. This leads to the Str145 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Moreover, the volume of the speech signal should be at a higher level than the background noise. This concept is called the signal-to-noise ratio or S/N. The international standard for classroom S/N is set at +15dB above the background noise for both traditional and distance-learning classrooms. This leads to the Str146 for the effective designing of the distance-learning classrooms (See Appendix 5-C). However, many studies have found that typical classrooms usually have noise levels exceeding those standards (Crandell and Smaldino, 2000; Flexer, 2005; Knecht et al., 2002; Nelson et al., 2005; Picard and Bradley, 2001; Sato and Bradley, 2008). Noise can derive from sources external to the university buildings, such as road traffic (Shield and Dockrell, 2003) or the cafeteria (Seep et al. 2000), and from inside the room, such as heating, ventilation and air conditioning (HVAC) systems, overhead projectors, the buzz from fluorescent lighting and papers shuffling in front of microphones.

These problems affect both traditional and distance-learning classrooms. However, most of the noise can be reduced once the sources are recognised. Some of the methods that could contribute to reducing the level of background noise are as follows:

When a location for a new building within the university is being considered, planners should avoid loud external noise sources, such as railroads and highways (Choi and McPherson, 2005; Allen et al., 1996; Seep et al., 2000).

When a source of noise comes from inside the classroom, for example, mechanical equipment, Siebein (2004) recommends the use of acoustical ceiling tiles, carpets on floors, curtains on windows and sound absorbers on walls to effectively reduce noise inside the classroom. This leads to the Str147 for the effective designing of the distance-learning classrooms (See Appendix 5-C). In addition, the seating should be arranged in such a manner that noise-generating electronic equipment is at a reasonable distance from it (Crandell and Smaldino, 2005).

However, Heating, Ventilation and Air Conditioning (HVAC) systems are almost always considered major sources of background noise in classrooms (Choi and McPherson, 2005; Nelson and Soli, 2000; Siebein, 2004; Seep et al., 2000; Sutherland and Lubman, 2004). According to Seep et al. (2000), a carefully selected noise-controlled (HVAC) system in the initial design of the classroom is the most effective way to eliminate a potential source of background noise. However, Seep et al. (2000) also recommend using quieter fans and duct insulation to reduce the noise level of already installed HVAC systems. This leads to the Str148 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Additional background noise sources in classrooms may include electronic equipment vibrations, dragging of desks and chairs and humming of fluorescent lights (Nelson and Soli, 2000; Smaldino and Crandell, 2000; Smaldino et al., 2005). However, minimising noise from these sources can be achieved by placing absorbent pads underneath furniture, using rubber tips on the legs of desks and chairs and regularly maintaining the ballast in fluorescent lights (Crandell and Smaldino, 2005). This leads to the Str149 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

In addition to all the above recommendations, it is advisable to install background noise cancellation devices in distance-learning classrooms. These devices are helpful in eliminating the problem of background noise being picked up by microphones and transmitted further. This leads to the Str150 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

Another factor worthy of mention that affects the noise level in classrooms is acoustic echo. The acoustic echo occurs when many distance-learning rooms speak with each other with open microphones and loudspeakers. Acoustic echo happens whenever a classroom's microphones pick up received audio of loudspeakers and send it back to the originating classroom (Figure 5.29).

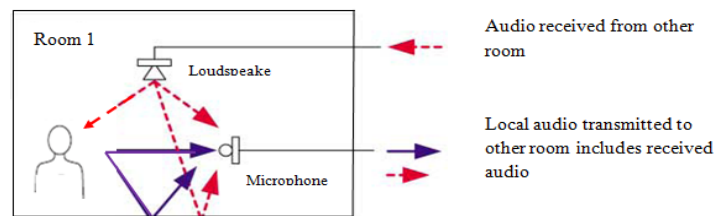


Figure 5.29: Acoustic Echo in Distance-learning Classroom

Figure 5.29 is an illustration of the possible pick-up path of audio, which can either be direct, i.e., a straight line from the loudspeaker to microphones, or indirect, i.e., hitting off the reflective surfaces before reaching the microphone. There is always a delay of time between the voice coming from the speaker and reaching the microphone. The time involved depends on the size of the learning room and its reverberant situation. This 'room delay', combined with any delays produced by the transmission path, will cause a delayed echo. The various ways in which acoustic echo can be addressed are discussed below.

Acoustic echo cancellers (AEC) are used to minimise acoustic echo. The device works in a bi-directional way. It is placed between the microphone mixer and the transmission system on one side and the receiving port and speaker system on the other.

The comparison of the received audio and the transmitted audio by acoustic echo cancellers (AEC) is done using digital signal processing (DSP) technology. The audio with characteristics the same as the received audio is eliminated from the transmission. Acoustic echo cancellers (AEC) have been considerably improved over time and are now very effective in eliminating both real-time echoes, as well as, delayed echoes (Figure 5.30).

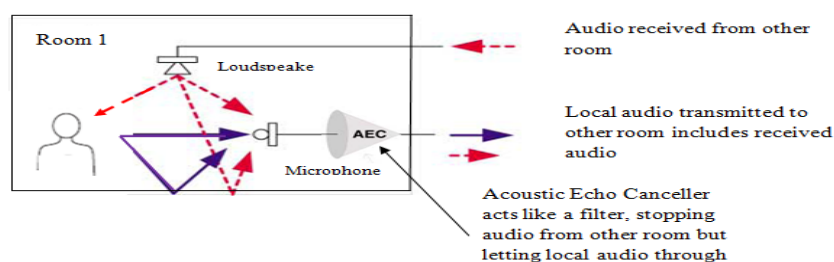


Figure 5.30: Acoustic Echo Canceller in Distance-learning Classroom

It must be mentioned here that AEC devices are of no benefit in classrooms where they are installed, as students will keep hearing their own echo. In fact, these devices are designed for students in other classrooms in the distance-learning network by removing their own audio from the audio being sent to them. In the distance-learning network, an AEC device has to be placed in each room to eliminate the acoustic echo at all sites (Figure 5.31). This leads to the Str151 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

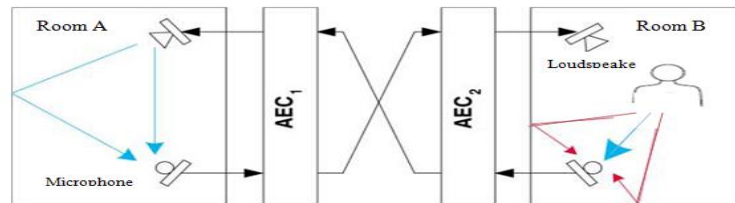


Figure 5.31: Acoustic Echo Canceller for Each Classroom

Illustrations of how acoustic echo cancellers work are shown in Figure 5.32 and Figure 5.33. Figure 5.32 shows the acoustic echo in the rooms. In Figure 5.33, the acoustic echo canceller is installed in room B, so acoustic echo is removed in room B and, as a result, those in room A do not hear their own audio.

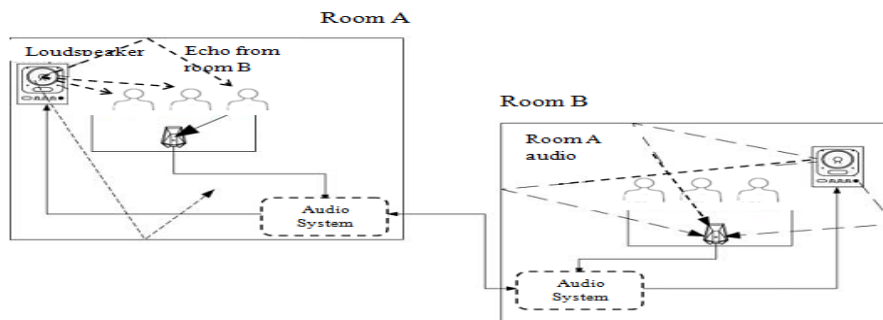


Figure 5.32: Acoustic Echo between Rooms

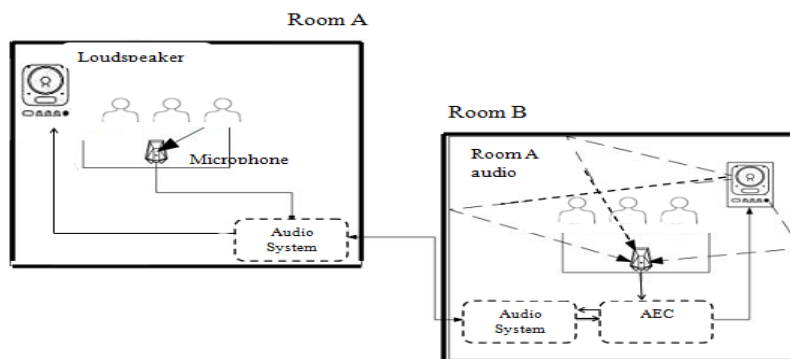


Figure 5.33: Acoustic Echo Canceller

Feedback is another factor that should be considered in distance-learning classrooms. The phenomenon of feedback occurs when an acoustic or electronic signal is ‘feeding back’ to its original source, becoming amplified and then going again through the cycle. There are two types of feedback:

- Electronic feedback happens when the output signal gets routed back to the input of the audio system due to errors.
- Acoustic feedback occurs when microphones are placed near the loudspeakers that carry the microphone audio (i.e. local sound reinforcement).

The problem of feedback in distance-learning room can be avoided if there is proper wiring of the sound system and telephonic equipment is replaced, as these are the usual causes. This leads to the Str152 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

It can be concluded that noise levels within the room and room acoustics are very important factors that should be given much consideration when distance-learning classrooms are being designed. Excellent room acoustics can be achieved by controlling four basic factors: the level of external noise, the noise disturbance from sources located inside the room (i.e. internal noise), the distribution of sound to all parts of the room, and finally, the elimination of problems like reverberation, echo and feedback in order to produce clear sound.

#### 5.2.15 Cleanness of the Learning Room

Cybela (1997) asserts that students should be provided with a pleasant learning environment. Such an environment should be clean, comfortable, well-maintained and conducive to learning. According to Lee (2002), students do not prefer a learning environment that includes cable wires running from the equipment across the floor because they might stumble on these wires. This leads to the Str153 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Lee and Forde (2002) recommend that all furnishings in the learning room, such as carpets, be cleanable, durable and/or replaced. This leads to the Str154 for the effective designing of the distance-learning classrooms (See Appendix 5-C). It is also advised that learning rooms be provided with suitable-size trash cans located near the doors. This leads to the Str155 for the effective designing of the distance-learning classrooms (See Appendix 5-C). It is further recommended that learning rooms be cleaned at least once a day after all classes are finished. This leads to the Str156 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

### 5.3 Technical Support in Distance-learning Classroom

Many international researchers have reported that the lack of technical assistance and equipment failure is one of the basic barriers faced by both instructors and students in the distance-learning classroom (Galusha, 1997; Dabaj, 2011). These issues are also the main concerns for both instructors and students in distance-learning (Talent-Runnells et al., 2006). In KSU, Al-Aboudi (2008) reported that there is a lack of technical support provided for the distance-learning classroom at KSU and students faced many problems in this regard. For example, there is no effective mechanism available for students to report technical problems, some equipment in the distance-learning classroom, such as microphones, does not work properly and is not repaired or replaced by the university. In addition, there is a lack in the number of female technical assistants in the female campus. Perreault et al. (2002) mentioned that both students and instructors can experience some technical barriers while involved in a distance-learning classroom due to a lack of experience in using the technology. If they are not provided with appropriate technical support and assistance, this might lead to many others problems such as feelings of frustration and anxiety. Therefore, the importance of providing appropriate technical support for the distance-learning classroom has been confirmed by many researchers (Pachnowski and Jurczyk, 2000). This can be achieved in many ways.

One of the ways that would be useful in this regard is by activating a maintenance agreement for the classroom equipment if such an agreement exists, or applying new one if not exist. Such a contract is signed between the university and a maintenance provider, and includes a set of terms and conditions that control the agreement between the two partners. All the maintenance services of the university are carried out by the maintenance provider in accordance with the terms and conditions of the agreement. Such an agreement differs from one service provider to another, but mostly covers many important issues related to the maintenance of equipment such as repairing, checking the working order of equipment, replacing broken equipment, etc. This leads to the Str157 for the effective designing of the distance-learning classrooms (See Appendix 5-C). It is also recommended that the university provides an effective channel for reporting technical problems in distance-learning classrooms. However, there are many useful methods that can be used in this regard, examples of these methods are as listed below:

- **Help Desk:** the help desk is a popular concept used in many universities around the world. It is an information and assistance office that solves technical problems faced by members of the university regarding computers, equipment in the classroom and

software. It also provides advice or consultation in this regard. However, university members can contact the help desk in many ways:

- **Telephones Numbers:** help desk can be contacted by telephone. Their numbers should be easily obtained e.g. such numbers can be added to the rear of the university card as used in many universities around the world, they can be printed on bulletins and installed outside classroom, labs, offices, in corridors, etc.
- **E-mail:** the help desk can be also be contacted through e-mail. Their e-mail address should be easily accessed. For example, it could be added to the reverse of the university card as used in many universities around the world, printed on bulletins and posted outside classroom, labs, offices, in corridors, etc.
- **Website:** the help desk can also be contacted through a website. The website usually includes a form that allows students to provide details of the problem they faced. This can then be submitted to the help desk. An example of such a form is shown in Figure 5.34. The URL of the help desk website should be provider in similar places to those in which telephone numbers and emails are available.

The form contains the following fields and sections:

- Name:
- Department:
- Phone:
- Email:
- Building where fault occurred:
- Room where fault occurred:
- Faulty Equipment**
  - Data Projector
  - Projector Controller
  - Audio
  - PC
  - Laptop
  - DVD-VHS Player
  - Overhead Projector
- Describe the problem providing as much detail as possible so as to help us rectify the issue in a timely manner.
- 

Figure 5.34: Reporting Faulty Equipment or Technical Issues Form

In addition to that, one of the useful methods that can be used in dealing with technical issues is an issue tracking system. This uses a computer software package to manage and maintain a list of issues by the help desk or the maintenance office in the university. This system allows staff to create, update, and resolve technical issues or complain reported by university

members, and allows the tracking of these requests with the use of a unique number This leads to the Str158 to Str161 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

It is also recommended that classrooms equipment should be checked regularly to ensure that they are in full working order. However, how frequently the equipment is checked will depend on many factors such as type of equipment, date of installation, etc. These factors are usually considered by the maintenance provider who determines how often the equipment is checked. However, Al-Aboudi (2008) has recommended that because of their frequent use, distance-learning classrooms equipment should be checked at least once a week to ensure that they are in full working order. This leads to the Str162 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

It is also recommended that all technical assistants should have adequate qualifications and be provided with adequate training and support to improve their skills. According to many researchers, technical support plays a crucial role in universities, companies, schools, etc. and qualified staff are often needed in these positions. To choose people for such positions, there are many important topics that are usually considered with regard to applicants such as education, experience, communication skills, problem solving skills, etc. These are as illustrated below:

- **Education:** most universities prefer that technical support jobs should be occupied by applicants who have a degree in computer science or a computer-related field. In addition to the degree, it is preferable that applicants usually have some specialist certification in the field of maintenance and IT support, such as that awarded by companies such as Microsoft and Cisco.
- **Experience:** it is preferable that applicants for technical support jobs should have basic experience in the field of maintenance, customer support and computer software and hardware. Applicants who have more than two years experiences in the field are preferred most.
- **Communication Skills:** it is preferable that applicants for technical support jobs should have good oral and written communication skills in addition to skills in how to deal with different users, and the ability to handle stress. These skills are essential when dealing with members of the university who are having technical problems.

- **Problem Solving Skills:** it is preferable that applicants for technical support jobs should have good skills in terms of problem solving.

This leads to the Str163 to Str166 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

#### **5.4 Classroom Management**

Although distance-learning provides instructors with the opportunity of expanding their classrooms beyond the confines of the building, it requires different skills and competencies than those needed in face-to-face instruction, and includes many instructional challenges for even the more experienced instructors (Verma, 2005). The literature review reveals that the role of the instructor in a distance-learning classroom is different from his/her role in a face-to-face situation. In the distance-learning classroom, instructors need to be aware of additional issues such as the use of the technology, its advantages and limitations, the design of the lesson, the ways of communicating with students and, most importantly, the methods of classroom management and dealing with problems of discipline (Willis, 1993; Paulsen, 1995; Cyr, 1997; De Verneil and Berge, 2000). Classroom management has been reported to be a primary concern of instructors of all levels of experience in traditional education (Johns et al., 1989; Weinstein and Mignano, 1993; Wolfgang, 1995; Weinstein, 1996; Smith, 2000; Goyette et al., 2000; Gee, 2001; Sokal et al., 2003) and has been the main reason that instructors resign from their positions after a relatively short career (Ryan, 1986; Browers and Tomic, 2000; Oliver and Reschley, 2007). According to Martin and Sass (2010) this issue is “a powerful element of the overall classroom climate as it impacts the level of student engagement, the frequency of inappropriate behaviour, and, by extension, the quality of student learning” (p.1). However, classroom management in distance-learning is more complicated than in the traditional classroom. In distance-learning, technology is added and instructors and students are separated in time, place or both. However, there is no doubt that the skills that make an instructor successful in a face-to-face classroom cannot be transferred directly to the distance-learning classroom, and that one of these important skills relate to classroom management (Schoenfeld-Tacher and Persichitte, 2000). In this section, classroom management will be discussed in detail. The discussion includes definitions of classroom management and the strategies that can be used to manage discipline problems in synchronous distance-learning classrooms.

#### 5.4.1 Definition of Classroom Management

Classroom management is considered one of the important factors that affect the learning process, and this topic has attracted educators and researchers during the past few decades (Emmer and Evertson, 1981; Rogers, 2000; Emmer and Stough, 2001; Jones and Jones, 2004; Evertson and Weinstein, 2006; Tauber, 2007; Martin and Sass, 2010). Evertson and Weinstein (2006, p.4) defined classroom management as:

“The actions instructors take to create an environment that supports and facilitates both academic and social-emotional learning. In other words, classroom management has two distinct purposes: It not only seeks to establish and sustain an orderly environment so students can engage in meaningful academic learning, it also aims to enhance students’ social and moral growth”

#### 5.4.2 Classroom Management in the Synchronous Distance-Learning Classrooms

In terms of the asynchronous distance-learning classrooms, the literature reveals a number of challenges instructors face in such an environment, including the indistinct monitoring of the performance of students and it is difficult to meet the individual needs of learners (Pernici and Casati, 1997; Relan and Gillani, 1997; Hunt, 1999). The challenges are usually greater in the synchronous classrooms. Instructors in the asynchronous classrooms play many roles, such as cognitive, affective, evaluative, performing and facilitator roles (Coppola et al., 2002). In the synchronous classrooms, instructors must play even more roles, including disciplinary and behaviour-management roles. Instructors should also use appropriate procedures and strategies to deal with these problems. A review of the literature has revealed some strategies that can be used to deal with discipline problems in the synchronous distance-learning environment. These will be discussed in the following section.

#### 5.4.3 Strategies for Managing Discipline Problems in the Synchronous Distance-Learning Environment

Due to a lack of research regarding classroom management in the distance-learning environment in Saudi Arabia, this study will use related international references into classroom management in the distance-learning. The literature review of the possible

strategies that can be used to manage discipline problems in synchronous distance-learning classrooms has led to the following result. Classroom management in a distance-learning classroom is an integrated process that includes four roles - role play by students, instructors, teaching assistants, and the technologies used.

In terms of the students, according to Fitzgibbon (2003), when students join a new teaching medium, it is natural that such students will have anxieties and difficulties in adapting to the new teaching medium that they have never experienced before. However, in the case of this study, the female students have spent at least eighteen years studying in a traditional classroom in completely segregated schools and have no experience of studying in another environment. According to Andrews and Klease (1998), new students at university have a traditional view about university education as well as certain expectations regarding the roles of students and instructors within. These concerns are related to face-to-face classrooms where instructors exist in the room. However, it is very likely that these concerns will be increased in the distance-learning classrooms as the instructors are non-existent in the same classroom with students and communication between them is carried out through technologies, such as video conferencing, where students can see their instructor on screens. It has been reported by many researchers that the authority of instructors in synchronous distance-learning classrooms is insufficient, since students just watch them on the screen. This situation makes students feel that there is no difference between such classes and watching television at home, which may lead to student discipline problems in the classroom. Andrews and Klease (1998) confirmed this point when talking about the distance-learning environment, stating that: "for most of us, watching television is a passive activity and we are not expected to respond to it" (p.23). However, in order to deal with such problems, students need help, guidance and to be provided with appropriate induction before joining such classrooms. Fitzgibbon (2003) has confirmed this and added, students who are studying through some form of distance-learning "need time as well as guidance and support before being plunged into a learning environment that they have little or no experience with" (p.30). Furthermore, Brown (2001) suggests that proper training should be given to those students who are new to technology-based teaching and learning. They should be given enough encouragement and institutional support so that they would be able to comprehend the idea and limitations of this environment and what they would be expected to give. This leads to the Str167 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Underwood (1989) mentioned that in order to develop listening skill in students, they

must be given encouragement before the courses by instructors and institutions and also make them discuss their problem they are facing with instructors. This leads to the Str168 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Furthermore, students should be also aware of the rules and procedures of the university, especially the part of it relating to the management of discipline problems. Students have a right to be informed about the regulations used in the university and what consequences will be applied in this regards. In addition to that, it has been reported by many researchers that instructors should encourage students in the distance-learning environment to be active as this will help to break the routine that students usually feel in this environment and will lead to a reduction in discipline problems. It is also important that instructors, in the first lecture, take some time to discuss with students the learning environment, its advantages and drawbacks, the contents of the course, ways of making contact with him, the rules that should be followed and what will happen if students break such rules, etc.

With regards to the instructor, there is no doubt that teaching students in distance-learning classrooms differs greatly from traditional teaching, where students and instructors are in the same place-time without being separated by technology. It is expected that instructors will face some challenges in the distance-learning environment and these are likely to increase in the case of this study where male instructors are not allowed to see female students but can only communicate with them orally. Many researchers has reported that it is necessary for both institutions and instructors to be aware that in order to be successful in teaching in a distance-learning environment, e.g. through video-conferences technology, it is essential to spend considerably more time and effort in organizing and structuring the course, even if an instructor has used this technology or taught the subject before (Schiller and Mitchell, 1993). According to Kimball (1998) it is very important that instructors realize that teaching students in distance-learning classrooms cannot succeed by taking the old lesson plans in traditional classroom and using them in a distance classroom. Rather, they will succeed by creating new teaching methods, as well as understanding the technologies being used with their advantages and limitations. However, there is no doubt that many institutions that use distance-learning spend a large amount of their resources (time and money) on preparing and training faculty to use the new technological tools, and on providing them with the required technical skills to deal with these technologies. Although such technical skills are very important, the faculty should also aware of many other skills, such as:

- How to promote student engagement in this new environment?

- How to adapt to the best pedagogical method for meeting the expectations and needs of the students in this new environment?
- How to facilitate collaborative learning in this new environment?
- How to guide and mentor students in this new environment?
- How to benefit from the knowledge provided by these technologies to support flexibility and collaboration and not just to use these new technologies to deliver the same old stuff?
- How to manage student behaviour and reduce discipline problems?

All of the above-mentioned roles, as well as other roles of instructors in distance-learning have been discussed widely in literature (Hiltz, 1995; Brandon and Hollingshead, 1999; Burns et al., 2001). The important role under consideration here is how to reduce discipline problems in distance-learning classrooms. To minimize such problems, Fitzgibbon (2003) suggests: “instructors should make an effort to create or build a classroom community at the beginning of a course” (p.31). This leads to the Str169 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Burns et al. (2000) indicated, that before conducting the course, it is recommended that instructors send a welcome letter to the students. This leads to the Str170 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Such a letter can include the following:

- Introduce the instructors to the students
- Give students some background about the environment they will learn in, (e.g. video—conference).
- Explains the aim of the subject.
- What will happen during the term (e.g. what topics will be covered, how students will be assessed)?
- What are the rules that students should be aware of, and what happen in case such rules are broken by students.

It is also recommended that instructors try to involve students in some activities, in order to allow them to get out of the routine, and to renew their energy during lectures. This will help to keep students interested and engaged in the classroom rather than just watching the instructor on a screen, which may lead to talking, inappropriate movement, disrupting their friends or other discipline problems. This leads to the Str171 for the effective designing of the distance-learning classrooms (See Appendix 5-C). According to Fitzgibbon (2003), it is recommended that instructors learn the students’ names in the distance-learning classroom, or

have a list of their names. They should try to call on them during the lecture to ensure that they are being kept involved in the learning process. This leads to the Str172 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

By keeping the students focused, the instructor can ensure student participation while reducing discipline problems. Burns et al. (2000) noted that instructors should emphasize that it is expected that everyone interact in lecture, and that participation points should be given. That will keep students' attention during lessons, and will make them try to participate to gain participation point. This leads to the Str173 for the effective designing of the distance-learning classrooms (See Appendix 5-C). The result will be a reduction of discipline problems. Burns et al. (2000) recommended that instructors should also give students feedback and comments regularly, as this will reduce feelings of isolation, and encourage their communication with the lecturer. It will also help to keep the students' attention and could help in reducing discipline problems. This leads to the Str174 for the effective designing of the distance-learning classrooms (See Appendix 5-C). Furthermore, instructors should be aware of the importance of teaching students about the technologies being used and improving their understanding of these technologies. Kimball (1998) claims that there is no doubt that if instructors have a better understanding of the technologies used in distance-learning, this will play a vital role in getting the attention of the students and in reducing unacceptable student behaviours. Furthermore, the strategies and styles of teaching always have the most significant role in student learning and behaviours. Kimball (1998) stressed that "when the learning process breaks down, we should not blame the technology, instead evaluate our teaching strategies" (p.3). As a result, it is essential that instructors are required sometimes to alter and improve the teaching approaches, and apply new strategies and approaches to manage the teaching-learning process efficiently on all levels. This leads to the Str175 for the effective designing of the distance-learning classrooms (See Appendix 5-C). However, according to Fitzgibbon (2003, p.33), some instructors do not give much attention to such improvement:

"In reading through eleven years of instructors' comments, I did not find any indication that the instructors experienced a personal sense of responsibility or obligation to learn more about technology-based teaching; nor did I come across any comment suggesting a need to examine personal teaching approaches"

Furthermore, instructors who have a positive attitude toward using technologies and teaching in distance-learning can often undertake the pedagogical and logistical responsibilities in an effective way, as many studies have confirmed (Gillies, 2008) and this will help instructors manage the problems they encounter, such as discipline problems. Moreover, Erdogan et al. (2010) have suggested that sometimes discipline problems can be overcome by giving students rules, and by applying the appropriate punishments, and by trying to discover the reasons behind problems. This leads to the Str176 for the effective designing of the distance-learning classrooms (See Appendix 5-C). To sum up, all of the strategies mentioned above will help instructors to manage distance-learning classrooms and reduce student discipline problems.

In terms of the teaching assistants, using teaching assistants in the synchronous distance-learning can also help to reduce discipline problems. During the review of relevant literature in the Saudi context and internationally, it has been discovered that most studies conducted in synchronous distance-learning technologies, especially audio and video conferences technologies, focus on many important aspects, such as the technologies, the changing roles of instructors, faculty technical training, and so on. However, few studies have addressed whether there is need for a teaching assistant in synchronous distance-learning classroom, and if so, what should be the assistant's skill set and role. Karal et al. (2009) conducted a study into the efficiency of appointing a teaching assistant in video-conferencing classrooms. The results of the study stress the necessity of the assistant in synchronous video conferencing where the assistant represents live authority in the classroom and can deal with numerous issues during lectures. This leads to the Str177 for the effective designing of the distance-learning classrooms (See Appendix 5-C). It is recommended that university provide the teaching assistants with appropriate training and support they may need (e.g. workshops to improve their skills in managing order in the classroom). This leads to the Str178 for the effective designing of the distance-learning classrooms (See Appendix 5-C).

In terms of the technologies, there is no doubt that technologies, specifically telecommunication technologies, have affected many aspects of our lives, and education is one of the fields that has been greatly affected by the technological revolution. It is also expected that over the next few years, telecommunications technologies will exert increasing impact over the ways in which learners learn and instructors teach. Many researchers have studied the impact of such technologies on the different dimensions of the teaching-learning process in distance learning. However, consideration will here be given to one particular

dimension, which relates to managing student behaviour and dealing with discipline problems in synchronous distance-learning environment (e.g. audio and video conferencing), and how technologies can be adopted to reduce such problems in classrooms. A review of the literature revealed that there is a wide range of studies that concentrate on the advantages of many synchronous distance-learning tools such as online chat (Murphy and Collins, 1997; Slack et al., 2003), audio conferencing (Nobes, 2003; De Schutter et al., 2004) and video conferencing (MacLaughlin et al., 2004; Anderson and Rourke, 2005). However, among these studies, very few have discussed how this technology can be used to reduce discipline problems in the classroom. According to Erdogan et al. (2010), one of the useful methods used to manage discipline problems when teaching through video conferencing is to request students who cause discipline problems and who are out of the camera's range to move to different seats in order to be seen by the instructor. An alternative is to control the camera to make it record different parts of the class during lectures, so that the instructor will see all the students. However, such strategy cannot be applied in the Saudi context, as it is not allowed for male instructors to see female students as illustrated at the beginning of this study. Another suggestion to reduce discipline problems is the controlling of the sound system on/off switch and to tell students that the system will cut the speaker's transmission off when someone speaks during lectures. This leads to the Str179 for the effective designing of the distance-learning classrooms (See Appendix 5-C). However, in addition to these strategies, there are some new technologies that can be used to reduce discipline problems. According to Stav et al. (2010), using a Personal Response System (PRS) can help to reduce discipline problems in classroom. This technology will allow the instructor to keep students involved in useful discussion and answering questions posted by the instructor through the lectures, which will help to keep the students' attention during lectures and reduce discipline problems. This leads to the Str180 for the effective designing of the distance-learning classrooms (See Appendix 5-C). However, an example of an innovative PRS that has been developed as part of this thesis will be discussed in next chapter (See Chapter 6). This system has been developed to support student communication and participation, and to solve other related problems students faced such as discipline problems.

## **5.5 Summary**

This chapter discussed the various problems relating to KSU's distance-learning environment, including physical design of the classroom, classroom physical features,

technical support and classroom management, and produced a list of strategies that should be followed for the effective design of the distance-learning classrooms. The next chapter discusses the process of designing, developing and testing of an innovative interactive communication system (CommEasy). This system has mainly been developed to enhance communication and interaction between instructors and their students in distance-learning classrooms and solve the problems students face in this regard.

# 6 CommEasy: an Innovative Interactive Communication System

This chapter discusses the process of designing, developing and testing an innovative interactive communication system (CommEasy) for smart handheld devices (iPhones/iPads), based on internet and wifi technologies. The system's name is an abbreviation of 'Easy Communication' due to its advantages in facilitating and supporting communication and participation in classrooms. This system has been developed mainly to enhance communication and interaction between instructors and their students in distance-learning classrooms and to solve the problems students face in this regard. This system encourages students to participate and ask questions during class, by providing them with a convenient and easy way to pose questions by use of their own smart handheld devices and guarantees them complete anonymity. The system allows students to pose questions for the instructors and for the instructors to respond and send answers to their students. It also allows instructors to pose questions for their students in the form of a quiz and obtain the results. Thus, in Saudi Arabia, this system will allow female students, who face problems in communication and participation with male instructors, such as being shy or embarrassed when talking to them, to pose their questions anonymously, without the need to talk to the male instructors.

## 6.1 Motivation and Pedagogical Considerations

The current decade is characterised by huge advancements in handheld devices, such as smart phones, which are used and owned by people all over the world (Anderson and Blackwood, 2004; Nooriafshar, 2012). This trend has affected many aspects of our lives, especially social aspects and personal interactions (Malinen and Ojala, 2012; Cui and Roto, 2008). This trend should not be ignored in the education setting. Many educators and researchers reported that the number of students who own handheld devices with internet capability has grown rapidly over the last few years, all over the world (Sharples et al., 2007; Corbeil and Valdes-Corbeil, 2007; Andrews et al., 2010). These students use their devices to access the internet frequently and most of them use their devices to access the internet on a daily basis (DeSantis, 2012). Many educators have reported that the use of mobile devices in higher education can enhance

the learning experience of the students, as well as increase participation and interaction in the classroom (Liu et al., 2002; Liu et al., 2003). For these reasons, the development and use of educational applications based on mobile devices has grown rapidly during the past few years. These applications have developed for many purposes and one of these is to support and increase students' engagement and participation in the classroom, as mentioned previously.

According to the report of the International Telecommunication Union (ITU) (2012), Saudi Arabia ranks first in the world in terms of the number of users of mobile devices. It has been reported that Saudi Arabia has the highest number of mobile phone users, more than any other country in the world, averaging 180 phones for every 100 Saudi citizens. Amongst these users, the percentage of people who own smart phones is 54% and 65% of these people use their smart phones to access the internet on a daily basis. Al-Fahad (2009) has reported that nowadays, there is a huge increase in the number of students who own and use mobile devices in higher education in Saudi Arabia. Such trends should not be ignored by educators and researchers in higher education in Saudi Arabia. Developing and using innovative educational applications based on mobile devices can help to enhance students' learning and solve or reduce problems that students face.

This study has taken advantage of this widespread use of smart phones in higher education in Saudi Arabia and the positive impact smart phones can have in the teaching-learning process and has developed an innovative interactive communication system that runs on smart handheld devices (iPhones and iPads) and can be used to enhance communication and interaction in the classroom and solve the problems students face in this regard.

This system contributes to solving the problems female student face in communicating and participating with male instructors in distance-learning classrooms. Female students who are shy or embarrassed to speak and ask questions or who cannot participate in lessons due to overcrowded classrooms or because they are too far from microphones can use this system to interact with male instructors and post their questions without having to speak directly to the male instructors or to use the microphones or even to leave their seats. This system guarantees them complete anonymity and they can receive responses to their questions on their devices once the instructors have answered them.

The value of the CommEasy system is that it helps to abolish all of these pressures and problems by providing students with a convenient way of asking questions, by using smartphones, which have become a way of life for students today, as mentioned earlier.

## 6.2 Requirement Determination and Analysis

The requirements for the CommEasy system were mainly determined using three methods: the results of the main questionnaire conducted during this thesis, the observations of similar technologies, and by building a prototype for the system and discussing it with students and instructors. These will be discussed as follows:

**The Results of the Questionnaire for Identifying the Perceptions of Female Students in KSU With Regard to the Problems They Faced:** The results of the questionnaire showed female students reported some problems in the distance-learning classrooms in KSU. Most of these problems were related to the difficulties in participation and communication with male instructors due to many reasons, such as female students were embarrassed to speak to the male instructors, there were an insufficient number of microphones, the microphones were too far from students, the classroom was crowded, etc. (See Chapter 7). The results of this questionnaire play a role in determining the requirements of the CommEasy system which has been developed in a way to handle and solve these problems, and provide female students and male instructors with a convenient tool that allows them to communicate with each other easily. The results of the questionnaire were not the only method for determining the requirements of the system, an observation of similar technologies has also been used, as discussed below.

**Observation of Similar Technologies:** As mentioned earlier in this thesis, huge advancements have been made in the technologies used in education to support the learning-teaching process in the classroom. The integration of these technologies into the classroom can help to support communication between students and instructors and improve students' participation during lectures, as proved by many researchers. For the purpose of gathering the requirements for CommEasy, a comprehensive literature review regarding the technologies that can be used to support communication and participation in the classroom was conducted, as presented in Chapter 2. Many technologies were discussed, such as the PRS, IW and Twitter. The features, limitations, hardware and software specifications of these technologies have been considered and analysed to determine the requirements of the CommEasy system. According to the results of this analysis, and the results of the questionnaire mentioned above, a list of desirable features for the CommEasy system was drawn up (See Appendix 6-A). These were subjected to further verification by students and instructors using a prototype, as will be discussed below.

**Prototyping of the System:** Creation of interactive prototypes demonstrates the functionalities of the system before its real development starts is a useful method for determining the requirements of the software and making sure that such requirements meet users' expectations. Software prototyping is very helpful because it allows developers to get valuable feedback from users regarding the software. However, there are many tools that can be used to create prototypes. In this thesis the Kenotopia templates tool has been used, because it enables the creation of interactive prototypes for mobile applications and supports the creation of prototyping for both iPhones and iPad.

Through analysis of the results of all three methods mentioned above, different types of information have been extracted for the CommEasy system, such as functional and non-functional requirements, data modelling, software and hardware requirements, use cases, etc. All of these will be discussed in the following sections.

### **6.3 Developing the System**

The CommEasy system will include two applications: the student application and the instructor application. Both applications will run on the individual iPhone / iPad devices of both students and instructors and will allow them to communicate interactively with each other.

The instructor application will enable the instructor to create a new class with venue, date and a unique access key. The students will gain access to this class using the access key given to them by their instructor and will be able to post questions for their instructors. The questions will appear on the instructor's application instantaneously. Once the instructors have answered the questions, the students will be able to view the answers. In addition, instructors will be able to create voting questions with multiple answers and allow students to respond to this voting. Furthermore, the system will allow instructors to post announcements to their students when required. Based on the above-mentioned description of the system, the functional requirements that usually define what a system is supposed to accomplish have been extracted and consist of a set of fifty-six functional requirements for CommEasy. However, there are twenty-two main functions of the system and for each of these a set of requirements has been defined to guarantee a successful accomplishment of the function (See Appendix 6-B).

In designing the system, a three-tier client/server model has used. A network connection was required for operation of the system. However, all iOS devices are equipped with adaptors for

easy access to wireless networks, which are freely provided by all academic institutions in Saudi Arabia. The high level architecture of the CommEasy is presented in Figure 6.1.

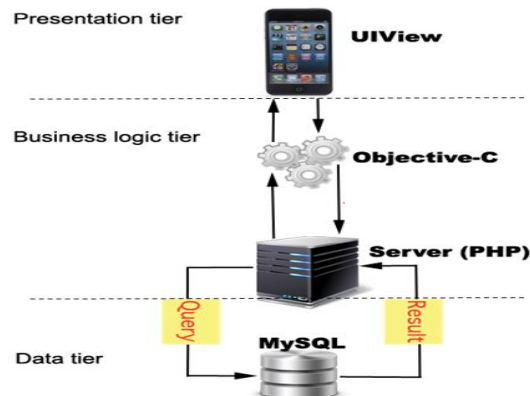


Figure 6.1: The System Architecture for CommEasy

As presented in Figure 6.1, the CommEasy system includes four main components: student application, instructor application, web service and the database. The student and instructor applications are all part of the presentation layer, which presents all the functionalities of the system that users directly interact with through effective GUI, designed mainly to provide an easy way of dealing with a system. The coordination between all system components is carried out in the logic layer by using a Web Services API deployed online on a server that connects to a storage layer, which includes the database used to store all the required information for the CommEasy system. The design of each of these components will be discussed in the following sections.

**The Design of Student and Instructor Applications:** It is recommended that the design of any GUI-based application should be guided by a Model-View-Controller (MVC) concept. This concept helps to design the applications more logically and organise the code in a way that ensures maximum reusability and extendibility of the system and makes any further changes or improvements to the system easy (Mark and LaMarche, 2008). This concept is a common concept used in almost all programming languages, of which Objective C is one. As demonstrated in Figure 6.2 MVC has been followed in the designing the applications.

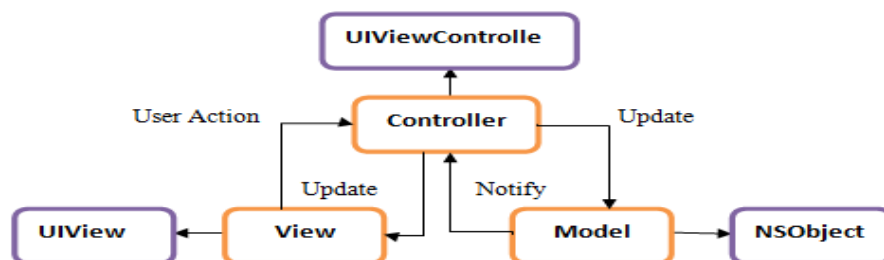


Figure 6.2: The MVC of the Student and Instructor Applications.

In Figure 6.2, the application is divided into three distinct modules:

- 1) The 'model' is responsible for the manipulation (creation/storage/updating) of the application data and includes all the classes that deal with the stored data and make all the logical actions/operations on this data. These classes are inherited from the root class in Objective C, NSObject.
- 2) The 'view' part is responsible for displaying and managing the graphical interfaces that users can directly interact with and receiving users input. All the classes included in this part are inherited from the UIView class in Objective C.
- 3) The 'controller' part is a moderator between the model and view modules. It includes all required classes to manage the communication between these two modules. The classes in controller are all inherited from the UIViewController class that manages a view in Objective C.

However, in some programming languages the view and model parts can interact directly with each other, but this is not the case in Objective C, and the model and view parts can only interact with each other through the controller.

**The Design of Database and Web Service API:** A central online backend database is required to store the data for the system so it can be commonly accessible to all users on iOS devices (iPhone and iPad). The proposed ERD diagram for the system is illustrated in Figure 6.3. The database for CommEasy has been created by using SQL based on this ERD diagram and these have been hosted on a reliable commercial server.

**The Design of the Web Service API:** In order to connect the application with the online database and store/retrieve various data sets within it, a common interface or API called web services is required. It provides web methods or functions to perform all kinds of storage/retrieval/update/add/delete operations on various datasets in the central database. The API is implemented in PHP.

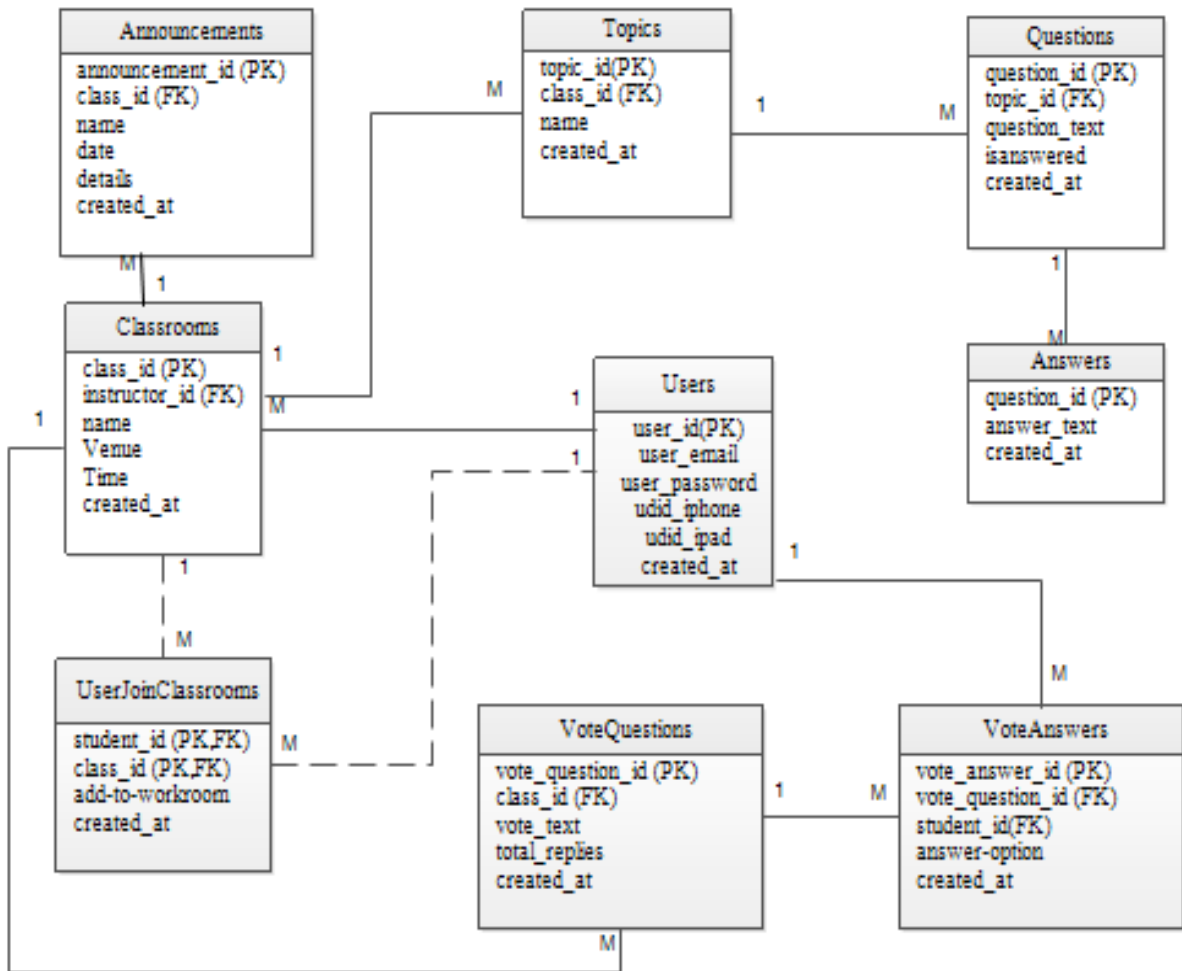


Figure 6.3: The ERD Diagram of CommEasy

In implementing the CommEasy, the incremental approach for software development was followed, where the requirements of the projects were divided into basic, intermediate and advanced requirements. This uses to help to organise and simplify both the implementation and testing of the project. These requirements have been further organised and divided into student application requirements and instructor application requirements, as each application is implemented separately in Xcode Development Environment. Once the implementation had been completed, the application was tested through an iOS Simulator and an iPhone device, as will be discussed later in the Testing section. This resulted in the creation of a CommEasy system with full functionalities that mainly enables:

- Students to pose questions to their instructors and receive answers.
- Instructors to set quizzes for students in order to achieve an understanding of their learning.
- Instructor to send out course announcements.

The basic functionalities are highlighted in the screenshot shown in Figure 6.4 to Figure 6.12.

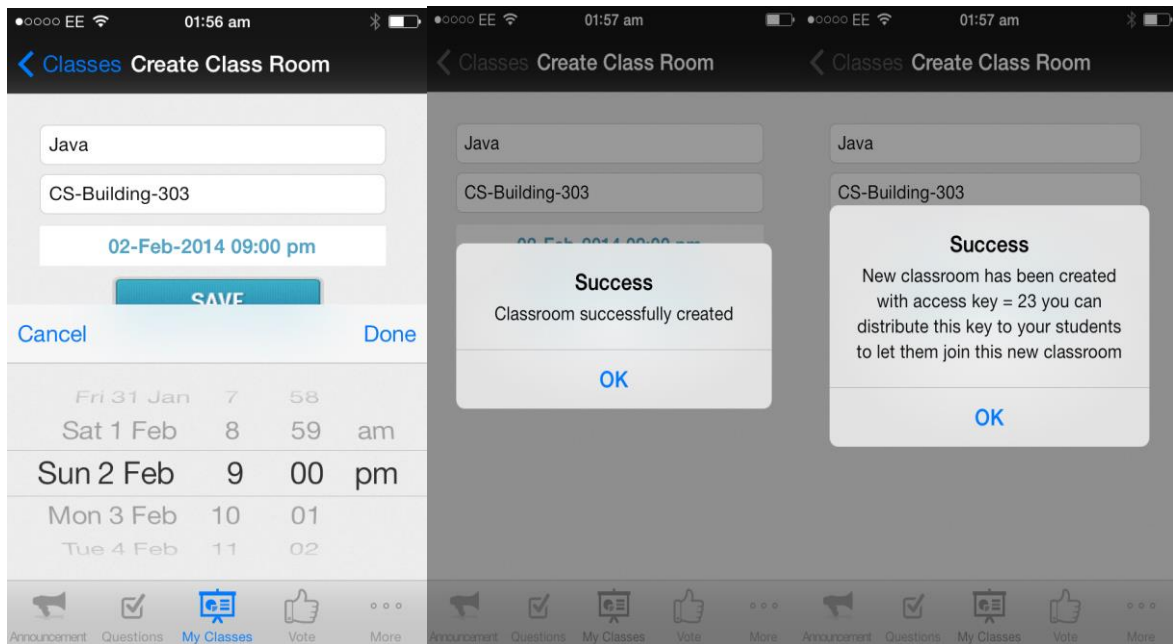


Figure 6.4: Created New Classroom in the Instructor Application.

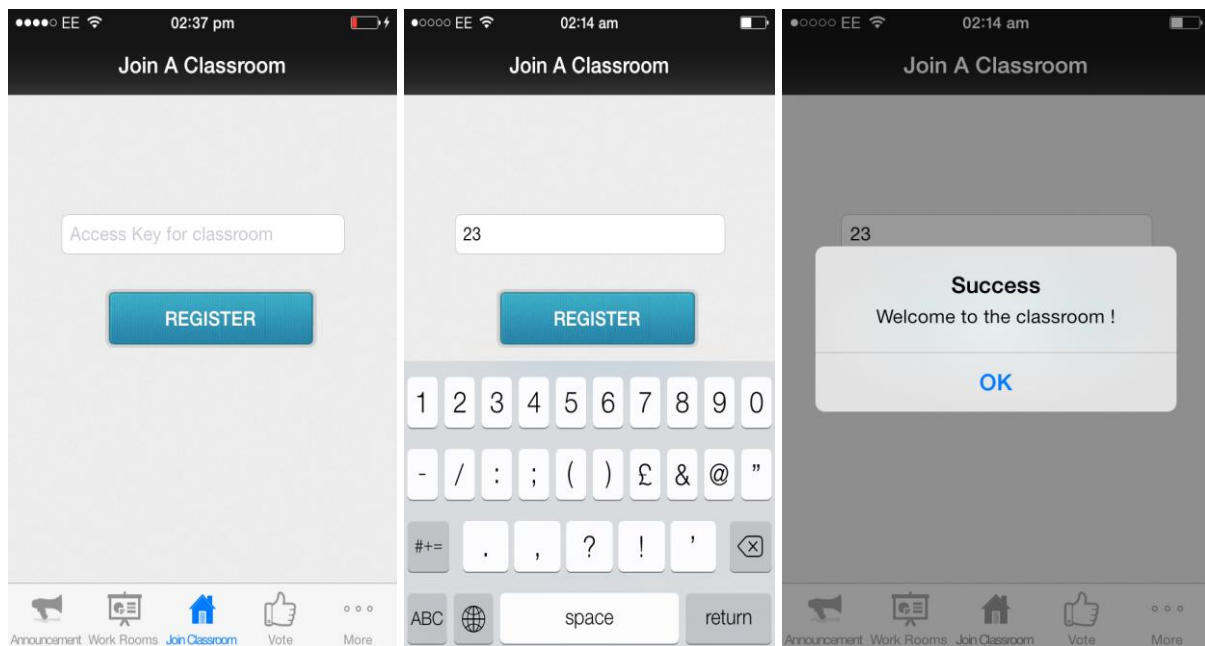


Figure 6.5: The Registration (Joining) the Classroom with The Access Key in the Student Application.

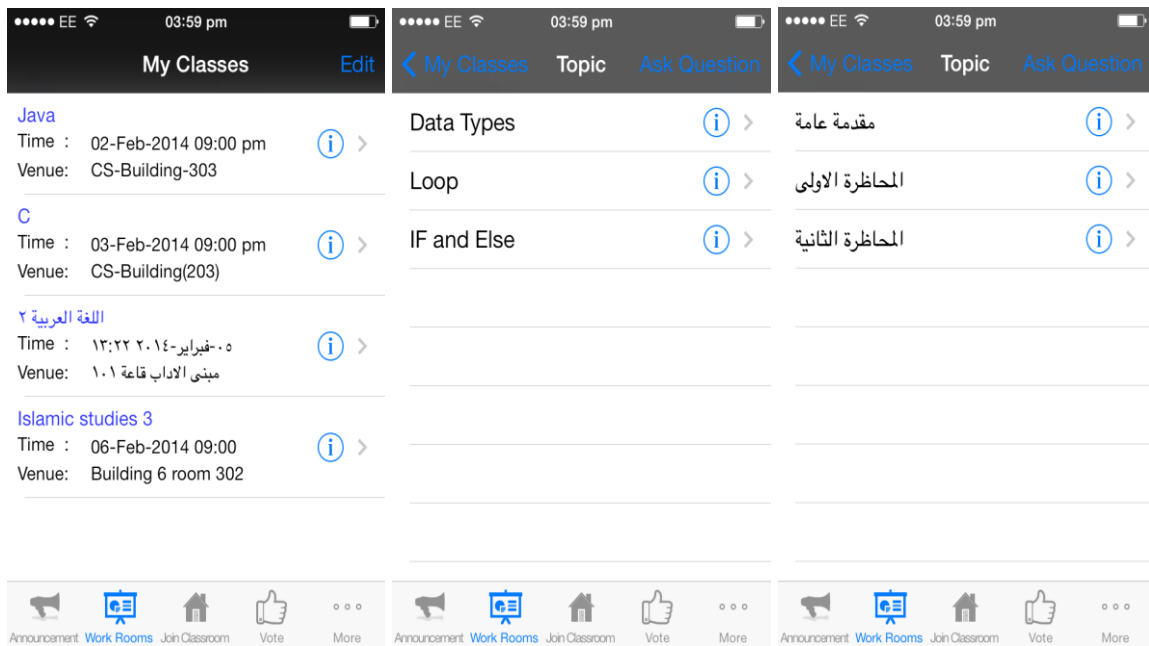


Figure 6.6: View the Classrooms and its Topics (Subjects) in the Student Application (e.g. in Java and Arabic Language 2).

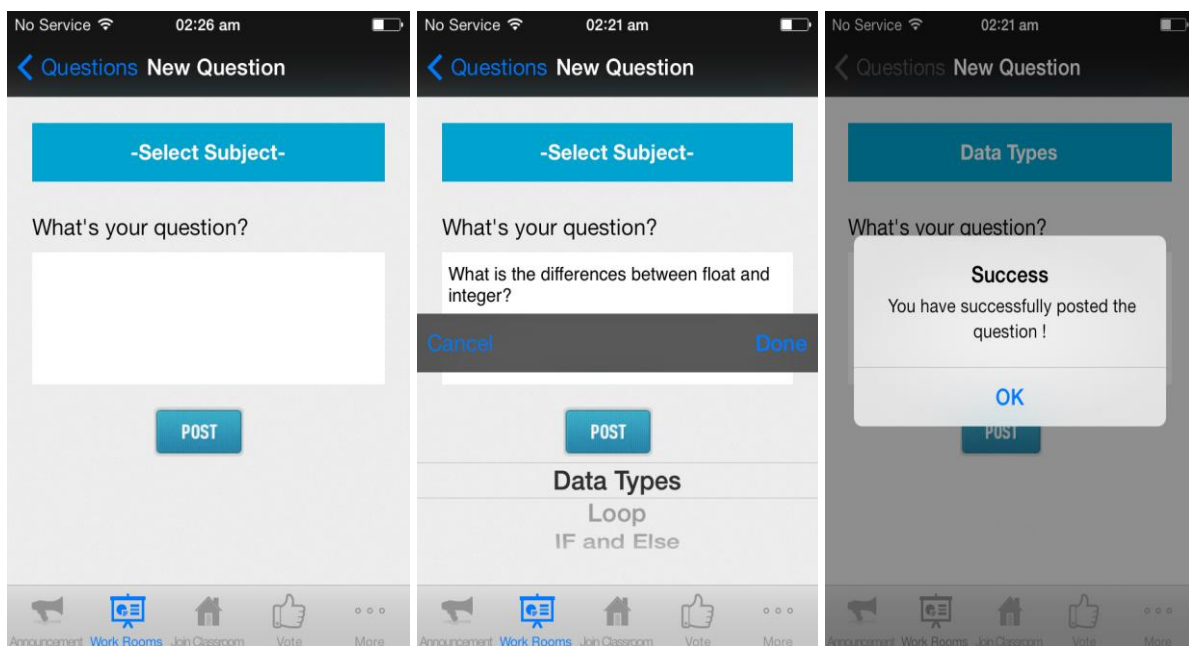


Figure 6.7: Posting the Question in Student Application.

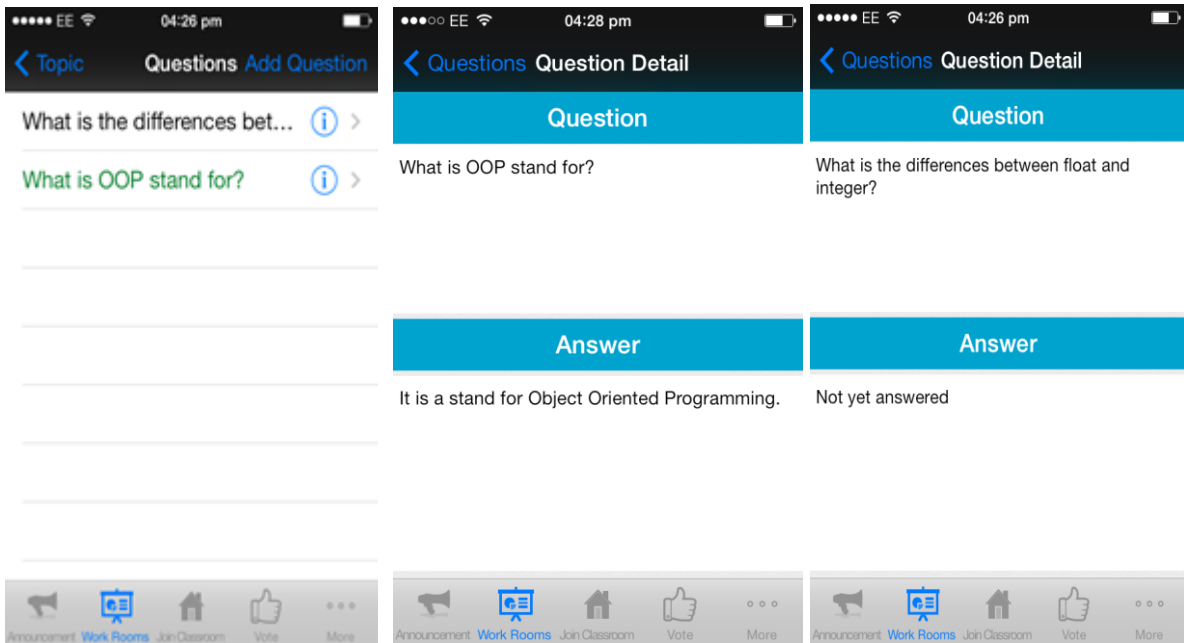


Figure 6.10: View Answered and Unanswered Questions in the Student Application

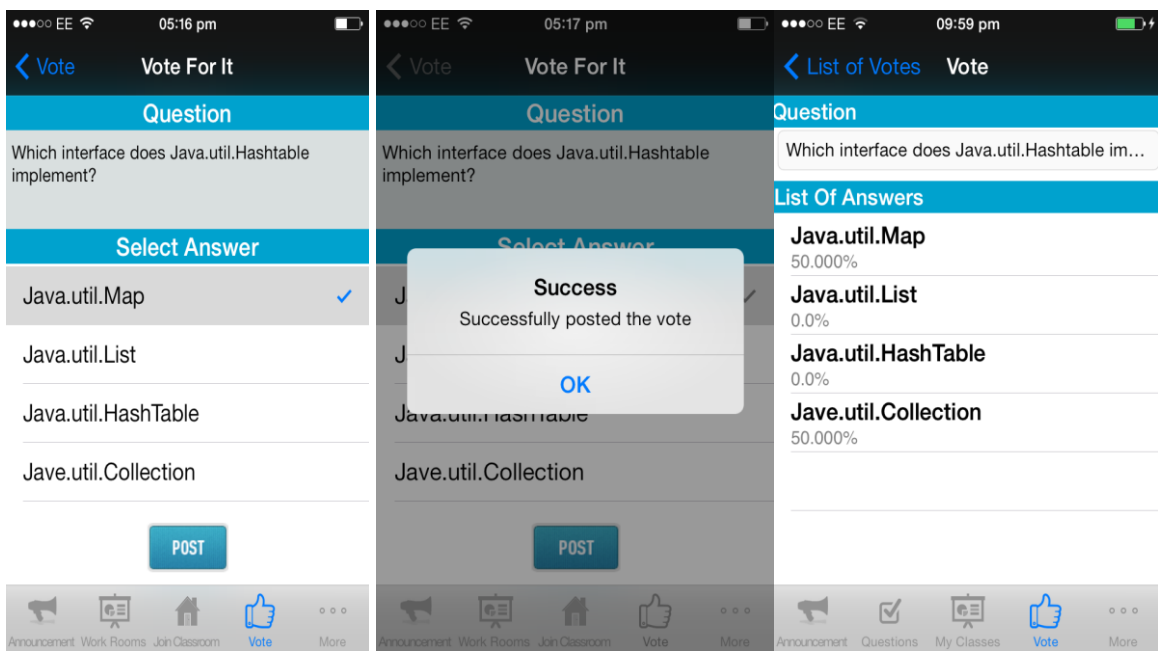


Figure 6.11: Answer the Voting Questions in the Student Application and View the Results of Voting in the Instructor Application

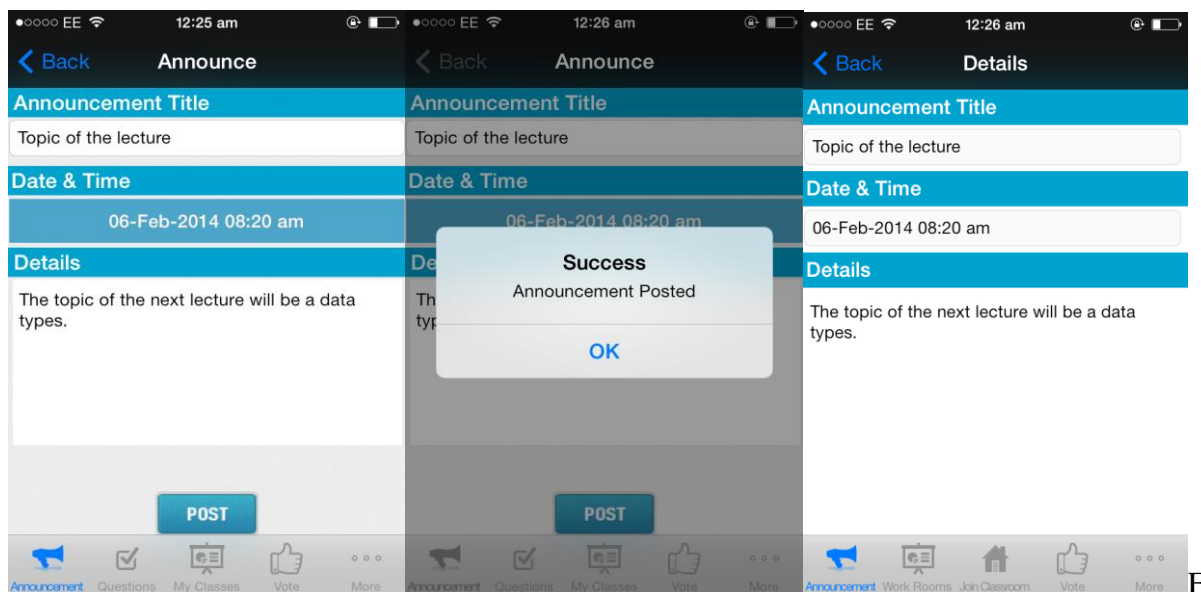


Figure 6.12: Create an Announcement in the Instructor Application and View the Announcements in the Student Application

#### 6.4 Testing and Evaluation

During the development of CommEasy, manual testing through iOS Simulator has been conducted to ensure that all functionalities were working successfully. The iOS Simulator was installed as part of the Xcode development environment and allowed simulation of several iOS devices, such as iPad and iPhone. Once all the functionalities of the system were implemented and tested through iOS Simulator, another advanced test was done to validate the system, by applying the heuristic evaluation usability engineering method based on heuristics provided by Jakob Nielsen. According to Nielsen (1994) “Heuristic evaluation involves having a small set of evaluators examine the application and judge its compliance with recognized usability principles (the “heuristics”)” (p.1). However, although Nielsen’s heuristics were mainly used to evaluate desktop applications, it still provides an excellent way of validating mobile applications. The validation of CommEasy was conducted by a group of 15 evaluators; five of them were PhD students majoring in CS and Software Engineering from three universities in the UK (the University of Sheffield, Durham University, and the University of Manchester). The others included two male instructors from KSU and eight female students from the College of Computer and Information Sciences in KSU. All of them were given an evaluation questionnaire to evaluate all aspects of the system (See Appendix 6-C and 6-D). The result of the validation revealed minor system errors and some comments in the GUI, which were all taken into account and the system was improved

accordingly. It was very important to conduct this validation before evaluation of the system in the actual learning environment by instructors and students. It allowed discovery and fixing of any issues that might affect the system and make it work incorrectly. The process of evaluating CommEasy in the actual learning environment has been discussed in detail in the methodology chapter (See Chapter 3.5) and the result of the evaluation will be presented in the next chapter, the Results Chapter.

### **6.5 Summary**

This chapter discussed the process of designing, implementing and testing an innovative interactive communication system (CommEasy) for smart handheld devices (iPhones/iPads). The results of the evaluation of this system in the actual learning environment will be presented in the next chapter and will be discussed in the Discussion Chapter (See Chapter 8).

# 7 Results and Findings

This chapter presents the results and findings of the thesis and organise in the following sections:

Data Analysis Procedures: this section summarises the procedures used to analyse the data relating to the thesis, and give an overview of all statistical tests used for this purpose.

Results of the Pilot Study: this section presents the results of the pilot study that have discussed previously in the Methodology Chapter (See Chapter 3.2).

Results of the Survey for Identifying the Perceptions of Female Students at KSU: this section presents the results of the survey that have discussed previously in the Methodology Chapter (See Chapter 3.3.1). In this section, the third research question of the study will be answered. The perceptions of the female students towards the problems they encounter in distance-learning classrooms in KSU will be presented in this section.

Results of the Students' Preparation Study: this section presents the results of the study regarding the role of students' preparation in reducing discipline problems in distance-learning classroom that have discussed previously in the Methodology Chapter (See Chapter 3.3.2.1). This section contributes in answering the fourth research question.

Results of the Teaching Assistants Study: this section presents the results of the study regarding the role of the teaching assistants in synchronous distance-learning classrooms in KSU that have discussed previously in the Methodology Chapter (See Chapter 3.3.2.2). This section contributes in answering the fourth research question.

Result of the CommEasy System Evaluation: this section presents the results of the evaluation of the CommEasy system that have discussed previously in the Methodology Chapter (See Chapter 3.5). This section answering the last research question.

The next chapter will discuss these results and will propose some feasible solutions for the common problems female students faced in KSU.

## 7.1 Data Analysis Procedures

A set of statistical tests was used to analyse the data obtained in this thesis, the details of which will be discussed in this section. In addition, a detailed description of how these tests were applied to the data will be provided later in this chapter.

In the statistical field, there are two common types of inferential statistics: parametric and nonparametric (Good and Hardin, 2012; Rubin, 2012; Sheskin, 2011; Corder and Foreman, 2009; Monsen and Horn, 2008). These statistical procedures can be distinguished according to the shape of the distribution in the underlying population. The parametric statistical procedures assume a normal distribution in the underlying population from which the sample was drawn, while no assumption has been made regarding the shape of distribution in the nonparametric procedures (Kothari, 2009; Monsen and Horn, 2008).

Both parametric and nonparametric procedures include several statistical tests which can be chosen for the purpose of analysing the collected data. It is worth mentioning that test selection should be done carefully to ensure that the most appropriate test for the available data is applied, since an inappropriate choice may lead to incorrect or unreliable results. To achieve this, it is essential to determine first whether or not the data to be analysed follows a normal distribution, and then the appropriate statistical tests can be chosen accordingly. If data are normally distributed, then one or more of the parametric statistical tests can be used. If not, one or more of the nonparametric statistical tests can be used. Distribution of the data will be discussed below.

### 7.1.1 Distribution of the Data

As stated above, in order to choose the statistical tests that will be used for the data analysis, it is important to first determine whether or not the collected data are normally distributed. Testing normality can be done by using graphical or numerical methods (Thode, 2002). The first method illustrates the differences between a theoretical distribution (i.e., the standard normal distribution, bell shaped) and an empirical distribution, while the second method provides summary statistics, such as kurtosis and skewness, and performs statistical tests of normality such as the Shapiro Wilks test or the Kolmogorov-Smirnov (K-S) test. The first method is simple to use and easy to interpret, while the numerical method provides a more objective way of examining normality.

In this thesis, the normality will be tested by the second method, using a statistical test. There are many kinds of statistical tests that can be used to test normality but the Shapiro Wilks and K-S tests are the most commonly used for this purpose. These two tests are usually distinguished according to the sizes of sample; the Shapiro Wilks test is usually applied with a small sample (less than 30) whereas the K-S test is used with a larger sample size. As the sample in this thesis is more than 30, the K-S test was used to assess normality. A brief overview of this test will be given below.

### 7.1.2 The Kolmogorov-Smirnov Test (K-S)

The K-S test is often used to determine the normality of data distribution by comparing the collected data to a normal distribution with the same mean and standard deviation of the sample. If the test is significant ( $p < 0.05$ ), then the data are not following a normal distribution (Wilcox, 2012), If the test is NOT significant ( $p > 0.05$ ), then the data are following a normal distribution,

In this thesis, the Kolmogorov-Smirnov test was used to determine whether or not the data are following the normal distribution, as will be presented in detail later in this chapter. After the completion of this test, the data analysis stage started. In the analysis of the data, two main types of statistics have been used: the descriptive statistics such as frequency, percentage, medium, IQR, minimum, etc., and the Paired t-Test to test the hypothesis that was posed in Chapter 1. A brief description of this test is given in the next section.

In addition to that, it is worth mentioning that the statistical packages SPSS and STATA were used in the analysis the data relating to this research. However, using these packages required that the non-numerical data that had to be analysed quantitatively had to be converted into numerical codes as will be shown later in this chapter.

### 7.1.3 The Paired t-Test

The Paired t-Test is one of the common parametric tests that is used widely across many disciplines. This test is used to compare the means of the same or related group(s) over time, or in differing circumstance. It is commonly used to compare one set of measurements with a second set from the same group. This test is often used in experimental studies to compare “before” and “after” observations for the same group, to decide whether or not significant differences exist. To use the test, the differences between the two observations (i.e. before and after) are calculated and used in the test. If the  $p$ -value  $< 0.05$ , this mean that there is a

significant difference in means across the paired observations, and so the null hypothesis is rejected. If the p-value  $> 0.05$ , this mean that there are no significant differences and the null hypothesis is accepted.

The Paired t-Test is based on the assumptions that the data follow the normal distribution. If not, another non-parametric equivalent test such as the Wilcoxon Sign Rank Test can be used.

## **7.2 Results of the Pilot Study**

This section presents the results of the Pilot Study. It begins with a description of the data validation procedures, which were conducted prior to the data analysis. Then, there is a brief discussion of the statistical procedures and the tests applied in the analysis, along with the important findings of the Pilot Study.

### **7.2.1 Data Validation**

Once the questionnaire was administrated to all participants and the data collected, all participants' responses were vetted for consistency and completeness (Kitchenham and Pfleeger, 2003; Shull et al., 2007). This validation of data was conducted prior to data analysis to avoid erroneous, irrelevant or missing data and to ensure the consistency and reliability of the final results of the study.

The questionnaire was administrated to 230 female students; all of them returned the questionnaires. In validating the data of these 230 questionnaires, only one questionnaire was rejected because it was returned without any response.

The remaining 229 questionnaires were completed by the participants and these were analysed to obtain the results.

### **7.2.2 Reliability and Validity of Data**

In order to test the survey's reliability, ten of the participants, who were undergraduate female students, were asked to fill in the questionnaire and their answers were saved. After two weeks, they were asked to fill in the questionnaire once more. The students provided the same answers as they had in the first survey. This indicated that the survey was reliable. For testing the validity, the content validity was tested with a university professor from the same field who agreed on all questions and on the structure of the questionnaire, helped to improve the contents of the questionnaire and approved the final version that was used in collecting the data of the study.

### 7.2.3 Procedures of the Data Analysis

The steps followed to analyse the data of the Pilot Study (See Appendix3-A) can be summarised as follows:

- Once the data was collected, it was coded and entered into the SPSS (see Section 7.2.4).
- Testing the normality was done to determine whether the data followed the normal or non-normal distribution and to determine the type of the statistical tests that would be used accordingly (see Section 7.2.5).
- The proper statistical tests were used on the data and the results were presented (see Section 7.2.6).

### 7.2.4 Data Coding

For the Pilot Study, all data were converted to a numerical format (i.e., Very Satisfied = 5 to Very Dissatisfied = 1). The evaluation scale was coded as follows: Excellent = 4; Good=3; Fair = 2; Poor = 1. This is positive coding, where the most positive answer is coded the highest.

### 7.2.5 Distribution of the Data

Testing the normality of the variables showed that it followed non-normal distribution,  $p < 0.05$  (see Table 7.1; Table 7.2) and so non-parametric statistics tests were more appropriate to use with all questions.

Descriptive Statistics and Tests for Normality: Satisfaction Questions									
Question	Label	n	Interquartile Range IQR	Median	Sum	Minimum	Maximum	Kolmogorov-Smirnov Z	Kolmogorov-Smirnov $p$
Q1	To what extent are you satisfied or dissatisfied with Video Conferences Technology?	229	2.00-2.00	2.00	492	1.00	5.00	6.99	<0.05
Q2	To what extent are you satisfied or dissatisfied with Audio Conference Technology?	229	2.00-2.00	2.00	477	1.00	5.00	7.15	<0.05

Table 7.1: Descriptive Statistics and Tests for Normality: Satisfaction Questions (See Appendix-3-A).

Table 7.1 shows the descriptive statistics (minimum, maximum, median, IQR and sum) and tests for normality (Kolmogorov-Smirnov test, along with  $p$ -value) for the satisfaction

questions. The minimum is the minimum code (answer) students choose for a particular question. The maximum is the maximum code (answer) students choose for a particular question. The sum is the total of all responses chosen by students. The median is the middle value of the code (answer) students choose, while the IQR measures dispersion of the central 50% of data, ignoring the external 25% on both sides.

Descriptive Statistics and Tests for Normality: Video and Audio Conference Ratings Questions									
Question	Label	n	Interquartile Range IQR	Median	Sum	Minimum	Maximum	Kolmogorov-Smirnov Z	Kolmogorov-Smirnov p
Q7_1	Facilitating communication with the male instructor (video conferences)	229	1.00-3.00	2.00	454.00	1.00	4.00	4.44	<0.05
Q7_2	The quality of images presented on the screens (video conferences)	229	1.00-2.00	2.00	405.00	1.00	4.00	4.37	<0.05
Q7_3	The audio quality of loudspeakers (video conferences)	229	1.00-3.00	2.00	426.00	1.00	4.00	4.29	<0.05
Q7_4	Managing discipline problems (video conferences)	229	1.00-2.00	1.00	385.00	1.00	4.00	5.22	<0.05
Q7_5	Facilitating communication with the male instructor (Audio Conference)	229	1.00-3.00	1.00	432.00	1.00	4.00	5.00	<0.05
Q7_6	Quality of the audio (Audio Conference)	229	1.00-2.00	1.00	392.00	1.00	4.00	5.26	<0.05
Q7_7	Managing discipline problems (Audio Conference)	229	1.00-2.00	1.00	399.00	1.00	4.00	5.14	<0.05

Table 7.2: Descriptive Statistics and Tests for Normality: Video and Audio Conference Ratings Questions (See Appendix-3-A).

Table 7.2 shows the results of the descriptive statistics and tests of normality for Video and Audio Conference Technologies Ratings Questions. It consists of similar columns as those discussed in Table 7.1.

#### 7.2.6 Results of the Pilot Study

As presented before, there were seven questions in the Pilot Study questionnaire (See Chapter 3.2). Students' answers for all these questions will be presented in this section. To answer these questions, descriptive statistics were used (median, IQR, frequency and percentage). With regards to questions 1 and 2, the majority (about 85%) of participants were either 'dissatisfied' or 'strongly dissatisfied' regarding the Video Conference Technology.

Similarly, students were overall ‘dissatisfied’ regarding the audio conferences, where about 90% of participants were either ‘dissatisfied’ or ‘strongly dissatisfied’ regarding this technology (Figure 7.1).

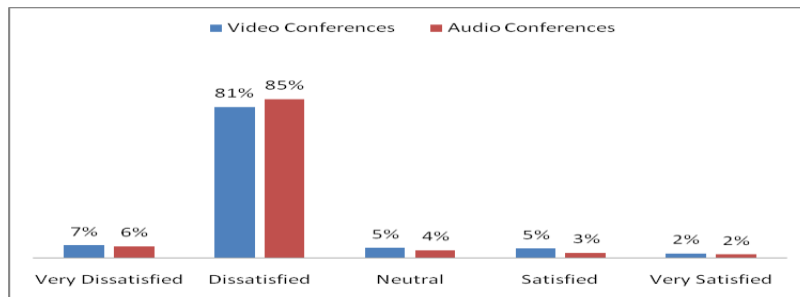


Figure 7.1: Results of Students' Satisfaction Regarding the Video and Audio Conference Technologies(n=229) (See Appendix-3-A).

With regard to questions 3 and 4, students' answers for the technologies that they preferred are shown in Table 7.3. About 52% of participants did not choose any of the technologies and among those remaining, only 5% preferred Video Conference Technology and only 2% preferred Audio Conference Technology, while 17% preferred to add new innovative technologies. The reasons that students did not prefer distance-learning technologies may be linked to the problems and difficulties faced by students studying via such technologies, and this may have led to many of them (20%) preferring face-to-face instruction with a female instructor rather than having to use any distance-learning technologies. The results of question 4 show that about 97% of participants confirmed that they faced problems while studying through distance-learning technologies.

Which technology do you prefer?		
Response	Frequency	Percentage
No Answer	65	28.38%
Nothing	55	24.02%
Prefer Face to Face	46	20.09%
Prefer new technologies	39	17.03%
Video Conferences	11	4.80%
Desktop Video Conferences	8	3.49%
Audio Conferences	5	2.18%
<b>Total</b>	<b>229</b>	<b>100.00</b>

Table 7.3: Technologies Students Preferred (See Appendix-3-A).

For question 5, the descriptive statistics show that 48% of participants rated Video Conference Technology as ‘poor’ in terms of facilitating communication with the male instructor, 19% rated it as ‘fair’ and 19% rated it as ‘good’, however, only 14% rated it as ‘excellent’ (Figure 7.2). For the quality of the images presented on the screens and the audio

quality of the loudspeakers, the majority of participants (more than 70%) rated it as either ‘poor’ or ‘fair’, whereas the minority (less than 30%) rated it as either ‘excellent’ or ‘good’ (Figure 7.2). For classroom management and problems of managing discipline, it was rated in a similar manner, with about 58% rating it as ‘poor’, 23% as ‘fair’ and the remaining 19% choosing either ‘good’ or ‘excellent’ (Figure 7.2). These results indicate that students were ‘dissatisfied’ with the current situation of this technology in respect to all the above-mentioned factors. However, the problems of managing discipline registered the highest number of students who perceived this factor as ‘poor’.

For Audio Conference Technology, the descriptive statistics show that the majority of participants (about 55% or more) rated audio conferencing as ‘poor’ in terms of facilitating communication with the male instructor, for the audio quality of the loudspeakers and for the problems of managing discipline. However, only 28% or less rated this technology as either ‘excellent’ or ‘good’ for any of these factors (Figure 7.3).

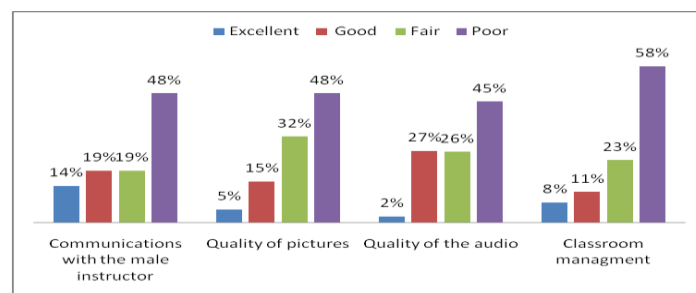


Figure 7.2: Results of the Video Conference Evaluation (n=229) (See Appendix-3-A).

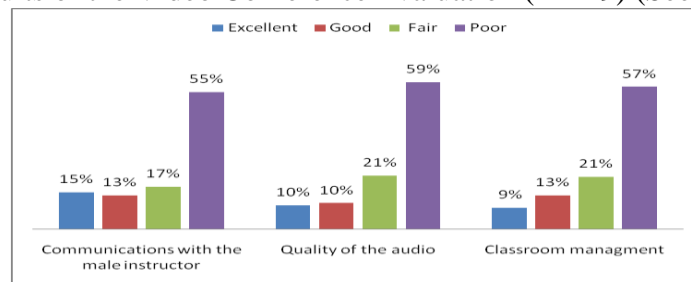


Figure 7.3: Results of the Audio Conference Evaluation (n=229) (See Appendix-3-A).

These results above indicate that students were, overall, dissatisfied with the current situation of these technologies in terms of facilitating communication with the male instructor, the quality of the images presented on the screens, the audio quality of the loudspeakers and the classroom management. It can be noted from these results that almost Video Conference Technology was rated better than Audio Conference Technology in terms of communication with the male instructors and the audio quality; however, both technologies were evaluated similarly for classroom management.

In terms of question 6: ‘What barriers (problems) do you face in these classrooms?’ Student answers for this question can be classified under three main themes:

**Classroom Management:** The majority of students, 89% (205 of 229), mentioned that discipline was one of the major problems faced them in the distance-learning classrooms. Problems such as disturbing peers, moving inappropriately, talking, and other problems were very common in these classrooms. Such problems affected the ability of other students to concentrate with male instructors and to understand the lectures, as mentioned by students. However, students commented that the authority of the male instructor in these classrooms was insufficient and most of the time the instructor did not realize what was happening in the female classrooms. They also mentioned that there is a lack in the number of female teaching assistants in these classrooms.

**Communication and Participation with Male Instructors:** The majority of students mentioned that they faced many problems in communication and participation with the male instructors in the distance-learning classrooms. About 83% (190 of 229) mentioned that they felt hesitant and embarrassed to participate with the male instructor because he was male and they were not used to speaking or dealing with males. About 78% (178 of 229) mentioned that they were not able to participate with a male instructor by asking questions or to answer the instructor’s questions for many reasons such as: the limited numbers of microphones in the classroom; the difficulty in reaching these microphones that were located on the walls or that the classroom was crowded. They mentioned that they usually participated more when they sat near to the microphones. They also reported that they faced problems in communicating with male instructors after the lectures.

**Technical Support:** Many students (84%, 192 of 229) mentioned that they faced many technical problems in the distance-learning classrooms, including the following: there was a lack of female technical assistants for the distance-learning classrooms, some equipment was either broken or did not work properly and this was not fixed or replaced by the university, also there was no effective methods for reporting technical problems and that there was no response to their calls on the telephone numbers which were provided.

In addition to that, a few students commented that they had encountered problems with the audio during lectures: the audio was sometimes too loud, too soft, not clear enough, and as a result, they could not understand what the instructors were saying. Also, a few students commented that the current televisions used in the classroom were small and too old.

In terms of question 7: ‘Would you like to add any further comments?’ For this question, many students commented on the importance of conducting this research and they showed a very positive attitude towards investigating these problems in detail, they mentioned that they hoped that these problems would be considered and solved as they affected their learning.

In summary, this section discussed the results of the Pilot Study, the next section will present the results of the survey for identifying the perceptions of female students in KSU towards the problems they faced in the distance-learning classrooms that used video conference technology.

### **7.3 Results of the Survey Identifying the Perceptions of Female Students in KSU Regarding the Problems They Faced in Distance-Learning Classrooms in KSU:**

This section presents the results of the survey that identified the perceptions of female students about problems they faced in their distance-learning classrooms. It begins with a description of the procedures for data validation, which was conducted prior to the data analysis. Next, there is a discussion of the statistical procedures and tests used in the analysis. The results of the questionnaire are then presented.

#### **7.3.1 Data Validation**

In this research, the questionnaire was administered to 112 female students, 107 of whom returned the questionnaire. In validating the data of these 107 questionnaires, 7 were rejected for the following reasons:

- Five of the questionnaires were returned without any response.
- In one questionnaire, only two questions from the section on physical features had been answered; therefore, this questionnaire was rejected on the basis of incomplete data.
- One questionnaire was also rejected because the participant chose all available options (i.e., Strongly Satisfied, Satisfied, Dissatisfied and Strongly Dissatisfied) for every question. As the inclusion of this questionnaire would have affected the result, it was rejected.

The remaining 100 questionnaires were appropriately and completely filled out by the participants, and the resulting data have been analysed to obtain the results which will be presented later in this chapter.

### 7.3.2 Reliability and Validity of the Data

The research instrument must be evaluated in terms of two criteria: reliability and validity (Kitchenham and Pfleeger, 2002; Johnson and Christensen, 2008; Bell, 2005). Reliability is related to the consistency or stability of the instrument and has 4 types: test-retest, equivalent-forms, internal consistency and inter-scorer (Johnson and Christensen, 2008). To assess the instrument's reliability, two types of reliability test were used. The first was the test-retest where the questionnaire was administered to a group of 15 female students and their responses were recorded. After one week the questionnaire was administered again to the same group. The responses were the identical at both stages, indicating that the instrument was reliable. The result of the test-retest may be affected by the interval between the first and second tests, however; this is considered to be a problem facing researchers using this type of reliability test (Johnson and Christensen, 2008). The internal consistency of survey items therefore is often tested by using a reliability coefficient, Cronbach's alpha. The reliability coefficient should be + 1.00 or close to +1.00 to indicate high reliability. Consequently, Cronbach's alpha was applied; the results (using the SPSS) were as follows: alpha of the contents of the equipment arrangement was 0.81; alpha of the contents of the classroom physical features was 0.96; alpha of the contents of the technical support in the classroom was 0.90; alpha of the contents of the classroom management and the communication with male instructors was 0.84. alpha for whole questionnaire was 0.96.

Validity is refer to how well the instrument measures what it is supposed to measure (Kitchenham and Pfleeger, 2002; Johnson and Christensen, 2008). The validity of the instrument was tested using the pilot study and the panel of experts, as discussed previously in the Methodology Chapter (See Chapter 3.3.1).

### 7.3.3 Data Coding

For the questionnaire, all data were converted to a numerical format (i.e., Strongly Satisfied = 5 to Strongly Dissatisfied = 1 and similarly Strongly Agree = 5 to Strongly Disagree = 1). This is positive coding, wherein the most positive answer is coded the highest.

### 7.3.4 Analysis Framework

The framework followed to analyse data from the survey (See Appendix 3-C) can be summarised into the following steps:

**Step\_1:** The data were coded, as discussed in Section 7.3.3, and entered into SPSS.

**Step\_2:** The normality of the distribution was assessed using the K-S test; the results show that the data was not normally distributed ( $p$  value  $< 0.05$ ) and, accordingly, that non-parametric statistical tests are more appropriate to use with this data if required (See Tables 7.4, 7.5, 7.6 and 7.7).

**Step\_3:** In analysis the results of the questionnaire, descriptive statistics (frequencies and percentages) were used to identify the perceptions of students towards the classroom components and explore the level of their satisfaction regarding these components. This section answered the third research question concerning students' perceptions.

**Step\_4:** All results were organised into an appropriate format and presented in Section 7.3.5.

Question	Label	Interquartile Range IQR	Median	Sum	Minimum	Maximum	Kolmogorov- Smirnov Z	Kolmogorov- Smirnov p
QI_1	How satisfied or dissatisfied are you with access to microphones in the classroom?	1.00 – 2.00	2.00	182	1.00	5.00	3.13	<0.05
QI_2	How satisfied or dissatisfied are you with the number of microphones in the classroom?	1.00 – 4.00	2.00	229	1.00	5.00	3.31	<0.05
QI_3	How satisfied or dissatisfied are you with the loudspeakers arrangement in the classroom??	2.00 – 4.00	4.00	339	1.00	5.00	3.29	<0.05
QI_4	How satisfied or dissatisfied are you with the arrangement of the instructor's camera??	4.00 – 4.00	4.00	381	2.00	5.00	3.52	<0.05
QI_5	How satisfied are you with the number of the screens in the classroom??	2.00 – 4.00	4.00	354	1.00	5.00	3.22	<0.05
QI_6	How satisfied or dissatisfied are you with the size of the screens?	2.00 – 2.00	2.00	207	1.00	5.00	4.73	<0.05
QI_7	How satisfied or dissatisfied are you with the quality of the pictures displayed by the screens (i.e. screen resolution)?	1.00 – 2.00	2.00	182	1.00	5.00	3.14	<0.05
QI_8	How satisfied or dissatisfied are you with the location of the screens in the classroom?	3.00 – 4.00	4.00	366	1.00	5.00	3.46	<0.05
QI_9	What is your overall satisfaction level with the current arrangement of the classroom equipment?	2.00- 4.00	4.00	312	1.00	5.00	2.68	<0.05

Table 7.4: Descriptive Statistics and Tests for Normality: Section I - Classroom Equipment Arrangement (n=100) (See Appendix 3-C).

Table 7.4 represents the results of the descriptive statistics and tests for normality for the arrangement of classroom equipment. It consists of the same columns as in Table 7. 1.

Question	Label	IQR	Median	Sum	Minimum	Maximum	Kolmogorov-Smirnov Z	Kolmogorov-Smirnov p
QII_1	How satisfied or dissatisfied are you with the size of the learning room?	3.00 - 4.00	4.00	360	1.00	5.00	3.35	<0.05
QII_2	How satisfied or dissatisfied are you with the width of the aisles in the learning room?	2.00 - 4.00	4.00	346	1.00	5.00	3.46	<0.05
QII_3	How satisfied or dissatisfied are you with the number of aisles in the learning room?	2.00 - 4.00	4.00	338	1.00	5.00	3.28	<0.05
QII_4	How satisfied or dissatisfied are you with the handicap access in the classroom?	3.00 - 4.00	4.00	364	1.00	5.00	2.53	<0.05
QII_5	How satisfied or dissatisfied are you with the noise level within the learning room?	2.00 - 4.00	4.00	331	1.00	5.00	2.60	<0.05
QII_6	How satisfied or dissatisfied are you with the lighting in the learning room?	2.00 - 4.00	4.00	347	1.00	5.00	3.45	<0.05
QII_7	How satisfied or dissatisfied are you with the acoustics of the learning room?	2.00 - 4.00	4.00	341	1.00	5.00	3.00	<0.05
QII_8	How satisfied or dissatisfied are you with the student desks in the learning room?	2.00 - 4.00	3.00	312	1.00	5.00	2.73	<0.05
QII_9	How satisfied or dissatisfied are you with the student chairs in the learning room?	2.00 - 4.00	4.00	322	1.00	5.00	3.22	<0.05
QII_10	How satisfied or dissatisfied are you with the number of windows in the learning room?	2.00 - 4.00	2.00	274	1.00	5.00	3.00	<0.05
QII_11	How satisfied or dissatisfied are you with the location of the windows in the learning room?	2.00 - 4.00	2.00	265	1.00	5.00	3.06	<0.05
QII_12	How satisfied or dissatisfied are you with the size of the windows in the learning room?	2.00 - 4.00	2.00	239	1.00	5.00	3.31	<0.05
QII_13	How satisfied or dissatisfied are you with the blinds/curtains in the learning room?	2.00 - 4.00	4.00	325	1.00	5.00	2.91	<0.05
QII_14	How satisfied or dissatisfied are you with the door in the learning room?	2.00 - 4.00	4.00	338	1.00	5.00	2.89	<0.05
QII_15	How satisfied or dissatisfied are you with the colour of the walls in the learning room?	2.00 - 4.00	3.00	300	1.00	5.00	2.91	<0.05
QII_16	How satisfied or dissatisfied are you with the floor in the learning room?	2.00 - 4.00	4.00	331	1.00	5.00	2.99	<0.05
QII_17	How satisfied or dissatisfied are you with the ceiling of the learning room?	2.00 - 4.00	4.00	351	1.00	5.00	3.28	<0.05
QII_18	How satisfied or dissatisfied are you with the temperature in the learning room?	2.00 - 4.00	4.00	354	1.00	5.00	3.35	<0.05
QII_19	How satisfied or dissatisfied are you with the ventilation in the learning room?	2.00 - 4.00	4.00	347	1.00	5.00	3.53	<0.05
QII_20	How satisfied or dissatisfied are you with the air-conditioning in the learning room?	3.00 - 4.00	4.00	352	1.00	5.00	3.43	<0.05
QII_21	How satisfied or dissatisfied are you with the cleanliness of the learning room?	4.00 - 4.00	4.00	363	1.00	5.00	3.72	<0.05
QII_22	What is your overall satisfaction level with the current physical features in the learning room?	2.00 - 4.00	4.00	331	1.00	5.00	3.95	<0.05

Table 7.5: Descriptive Statistics and Tests for Normality: Section II - Classroom Physical Features (n=100) (See Appendix 3-C).

Table 7.5 represents the results of the descriptive statistics and tests for normality for the classroom physical features. It consists of the same columns as in Table 7. 1

Question	Label	Interquartile Range IQR	Median	Sum	Minimum	Maximum	Kolmogorov-Smirnov Z	Kolmogorov-Smirnov p
QIII_1	How satisfied or dissatisfied are you with the performance of technical assistants in terms of their ability to solve technical problems?	2.00 - 3.00	2.00	231	1.00	5.00	3.40	<0.05
QIII_2	How satisfied or dissatisfied are you with the amount of time that is taken to solve these technical problems?	2.00 - 4.00	2.00	258	1.00	5.00	2.78	<0.05
QIII_3	How satisfied or dissatisfied are you with the working order of the equipment in the distance-learning classroom?	2.00 - 4.00	2.00	263	1.00	5.00	2.96	<0.05
QIII_4	What is your overall satisfaction level with the current technical support provided in the distance-learning classroom?	1.00 - 4.00	2.00	247	1.00	5.00	2.58	<0.05

Table 7.6: Descriptive Statistics and Tests for Normality: Section III - Technical Support (n=100) (See Appendix 3-C).

Table 7.6 represents the results of the descriptive statistics and tests for normal distribution for the technical support. It consists of the same columns as in Table 7. 1.

Question	Label	Interquartile Range IQR	Median	Sum	Minimum	Maximum	Kolmogorov-Smirnov Z	Kolmogorov-Smirnov p
QB_1	I am hesitating in participation with instructors because he is a man.	4.00 - 5.00	4.00	417	1.00	5.00	3.21	<0.05
QB_2	I am not given a chance to participate with the instructor because the classroom is crowded.	4.00 - 5.00	4.00	387	1.00	5.00	3.55	<0.05
QB_3	I am participating more when I sit near the microphones.	3.00 - 5.00	4.00	375	1.00	5.00	3.18	<0.05
QB_4	I did not attend distance learning classes because I found that I couldn't engage in the classroom.	2.00 - 4.00	2.00	240	1.00	5.00	3.25	<0.05
QB_5	The authority of the male instructors is insufficient.	4.00 - 5.00	4.00	391	1.00	5.00	3.63	<0.05
QB_6	The behaviour of some students in the classroom (e.g. making noise, inappropriate movements and disturbing peers) greatly affects my ability to concentrate on the instructor..	4.00 - 5.00	4.00	380	1.00	5.00	3.46	<0.05
QB_7	I can't communicate with the instructor after a lecture.	3.00 - 5.00	4.00	361	1.00	5.00	3.01	<0.05

Table 7.7: Descriptive Statistics and Tests for Normality: Section IV – Classroom Management and Communication with Instructors (n=100) (See Appendix 3-C).

Table 7.7 represents the results of the descriptive statistics and tests for normality for the classroom physical features. It consists of the same columns as in Table 7.1.

### 7.3.5 Findings of the Study

**Description of the Sample:** The sample for this study comprised participants with the following criteria: female, full-time undergraduate students, Computer Science majors, 20 to 25 years old and involved in an Islamic studies subject when this questionnaire was administered.

**Results of the Survey:** the perceptions of the students regarding the current components of the distance-learning classrooms were as follows.

**Classroom equipment arrangements:** Part 1 of the survey measured students' perceptions of classroom equipment arrangement. The results of the analysis of their responses are summarised as follows:

The majority of students (67%) were satisfied with the current number of screens in the classrooms (48% were satisfied and 19% were strongly satisfied) (Table 7.8). Regarding the locations of the screens in the classroom, the majority were also satisfied; 52 % were satisfied and 21% strongly satisfied (Table 7.9). Most, however, were dissatisfied with the quality of images on the screens (54% were dissatisfied and 36% strongly dissatisfied) (Table 7.10). Most were also dissatisfied with the size of the screens (85%); 8% were very dissatisfied; and just 6% were satisfied (Table 7.11).

Question	How satisfied or dissatisfied are you with the number of screens in the classroom?				
Response	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
Frequency	5	22	6	48	19
Percentage	5%	22%	6%	48%	19%

Table 7.8: Student Satisfaction Regarding Number of Screens in the Classrooms (n=100)  
(See Appendix 3-C).

Question	How satisfied or dissatisfied are you with the location of the screens in the classroom?				
Response	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
Frequency	6	16	5	52	21
Percentage	6%	16%	5%	52%	21%

Table 7.9: Student Satisfaction Regarding the Locations of Screens in the Classrooms (n=100) (See Appendix 3-C).

Question	How satisfied or dissatisfied are you with the quality of the pictures displayed by the screens (i.e. screen resolution)?				
Response	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
Frequency	36	54	3	6	1
Percentage	36%	54%	3%	6%	1%

Table 7.10: Student Satisfaction Regarding the Quality of Pictures in Screens (n=100) (See Appendix 3-C).

Question	How satisfied or dissatisfied are you with the size of the screens?				
Response	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
Frequency	8	85	1	4	2
Percentage	8%	85%	1%	4%	2%

Table 7.11: Student Satisfaction Regarding the Size of Screens in the Classrooms (n=100)  
(See Appendix 3-C).

With regard to microphones in the classrooms, the majority of participants were dissatisfied regarding both the number of microphones as well as their access (Tables 7.12 and 7.13).

Question	How satisfied or dissatisfied are you with the number of microphones in the classroom?				
Response	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
Frequency	29	45	1	18	7
Percentage	29%	45%	1%	18%	7%

Table 7.12: Student Satisfaction Regarding the Number of Microphones in the Classrooms (n=100) (See Appendix 3-C).

Question	How satisfied or dissatisfied are you with access to microphones in the classroom?				
Response	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
Frequency	40	49	2	7	2
Percentage	40%	49%	2%	7%	2%

Table 7.13: Student Satisfaction Regarding Access to the Microphones (n=100) (See Appendix 3-C).

In terms of the instructor's camera arrangements and loudspeaker arrangements in the classrooms, these two components were rated as satisfactory by the majority of students at 78 % and 74%, respectively (Tables 7.14 and 7.15).

Question	How satisfied or dissatisfied are you with the arrangement of the instructor's camera?				
Response	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
Frequency	5	9	8	56	22
Percentage	5%	9%	8%	56%	22%

Table 7.14: Student Satisfaction Regarding Instructor's Camera Arrangements (n=100) (See Appendix 3-C).

Question	How satisfied or dissatisfied are you with the loudspeakers arrangement in the classroom?				
Response	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
Frequency	13	17	5	48	17
Percentage	13%	17%	5%	48%	17%

Table 7.15: Student Satisfaction Regarding the Arrangement of Loud Speakers (n=100) (See Appendix 3-C).

In terms of the overall satisfaction level of students towards the current classroom physical design, the results indicated that 51 % of students were satisfied about the current physical design, whereas 41% were dissatisfied and 8% were neutral (Table 7.16).

Question	What is your overall satisfaction level with the current arrangement of the classroom equipment?				
Response	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
Frequency	10	31	8	39	12
Percentage	10%	31%	8%	39%	12%

Table 7.16: Overall Student Satisfaction with the Current Physical Design (n=100) (See Appendix 3-C)

Classroom physical features: Part 2 of the survey measured students' perceptions of classroom physical features. It can be concluded from the results of this part that most classroom physical features were satisfactory for the participants. For most physical features, the satisfaction level of students ranged between 54% and 75% (Table 7.17). There were also, however, some features that most of students were dissatisfied with, such as the size of the windows, their locations and numbers with 71%, 62% and 59% respectively (Table 7.17). In addition to this, for two features (the students' desks and the colour of the learning room), the total number of satisfied students was very close to that of those who were dissatisfied; 47% were satisfied with the students' desks; 45% were dissatisfied; while the remainder were neutral (8%). Similar results appeared regarding the colour of the learning room with 49% satisfied; 47% dissatisfied; while the remainder were neutral. Details of the students' perceptions regarding these features is presented in Table 7.17.

<table border="1"> <thead> <tr> <th>Question</th> <th colspan="5">How satisfied or dissatisfied are you with the size of the learning room?</th> </tr> <tr> <th>Response</th> <th>VD</th> <th>D</th> <th>N</th> <th>S</th> <th>VS</th> </tr> </thead> <tbody> <tr> <td>Frequency</td> <td>9</td> <td>16</td> <td>4</td> <td>48</td> <td>23</td> </tr> <tr> <td>Percentage</td> <td>9%</td> <td>16%</td> <td>4%</td> <td>48%</td> <td>23%</td> </tr> </tbody> </table>	Question	How satisfied or dissatisfied are you with the size of the learning room?					Response	VD	D	N	S	VS	Frequency	9	16	4	48	23	Percentage	9%	16%	4%	48%	23%	<table border="1"> <thead> <tr> <th>Question</th> <th colspan="5">H How satisfied or dissatisfied are you with the width of the aisles in the learning room?</th> </tr> <tr> <th>Response</th> <th>VD</th> <th>D</th> <th>N</th> <th>S</th> <th>VS</th> </tr> </thead> <tbody> <tr> <td>Frequency</td> <td>8</td> <td>19</td> <td>6</td> <td>53</td> <td>14</td> </tr> <tr> <td>Percentage</td> <td>8%</td> <td>19%</td> <td>6%</td> <td>53%</td> <td>14%</td> </tr> </tbody> </table>	Question	H How satisfied or dissatisfied are you with the width of the aisles in the learning room?					Response	VD	D	N	S	VS	Frequency	8	19	6	53	14	Percentage	8%	19%	6%	53%	14%
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<b>Question</b>	<b>How satisfied or dissatisfied are you with the acoustics of the learning room?</b>				
<b>Response</b>	VD	D	N	S	VS
Frequency	6	29	3	42	20
Percentage	6%	29%	3%	42%	20%

<b>Question</b>	<b>How satisfied or dissatisfied are you with the student desks in the learning room?</b>				
<b>Response</b>	VD	D	N	S	VS
Frequency	4	41	8	33	14
Percentage	4%	41%	8%	33%	14%

<b>Question</b>	<b>How satisfied or dissatisfied are you with the student chairs in the learning room?</b>				
<b>Response</b>	VD	D	N	S	VS
Frequency	11	26	4	48	11
Percentage	11%	26%	4%	48%	11%

<b>Question</b>	<b>How satisfied or dissatisfied are you with the number of windows in the learning room?</b>				
<b>Response</b>	VD	D	N	S	VS
Frequency	17	42	3	26	12
Percentage	17%	42%	3%	26%	12%

<b>Question</b>	<b>How satisfied or dissatisfied are you with the size of the windows in the learning room?</b>				
<b>Response</b>	VD	D	N	S	VS
Frequency	25	46	2	19	8
Percentage	25%	46%	2%	19%	8%

<b>Question</b>	<b>How satisfied or dissatisfied are you with the location of the windows in the learning room?</b>				
<b>Response</b>	VD	D	N	S	VS
Frequency	20	42	2	25	11
Percentage	20%	42%	2%	25%	11%

<b>Question</b>	<b>How satisfied or dissatisfied are you with the blinds/curtains in the learning room?</b>				
<b>Response</b>	VD	D	N	S	VS
Frequency	12	27	3	40	18
Percentage	12%	27%	3%	40%	18%

<b>Question</b>	<b>How satisfied or dissatisfied are you with the door in the learning room?</b>				
<b>Response</b>	VD	D	N	S	VS
Frequency	13	17	9	41	20
Percentage	13%	17%	9%	41%	20%

<b>Question</b>	<b>How satisfied or dissatisfied are you with the colour of the walls in the learning room?</b>				
<b>Response</b>	VD	D	N	S	VS
Frequency	8	39	4	43	6
Percentage	8%	39%	4%	43%	6%

<b>Question</b>	<b>How satisfied or dissatisfied are you with the floor in the learning room?</b>				
<b>Response</b>	VD	D	N	S	VS
Frequency	11	25	4	42	18
Percentage	11%	25%	4%	42%	18%

<b>Question</b>	<b>How satisfied or dissatisfied are you with the ceiling of the learning room?</b>				
<b>Response</b>	VD	D	N	S	VS
Frequency	9	21	2	46	22
Percentage	9%	21%	2%	46%	22%

<b>Question</b>	<b>How satisfied or dissatisfied are you with the temperature in the learning room?</b>				
<b>Response</b>	VD	D	N	S	VS
Frequency	2	24	7	52	15
Percentage	2%	24%	7%	52%	15%

<b>Question</b>	<b>How satisfied or dissatisfied are you with the ventilation in the learning room?</b>				
<b>Response</b>	VD	D	N	S	VS
Frequency	8	19	5	54	14
Percentage	8%	19%	5%	54%	14%

<b>Question</b>	<b>How satisfied or dissatisfied are you with the air-conditioning in the learning room?</b>				
<b>Response</b>	VD	D	N	S	VS
Frequency	6	19	7	53	15
Percentage	6%	19%	7%	53%	15%

Question	How satisfied or dissatisfied are you with the cleanliness of the learning room?					Question	What is your overall satisfaction level with the current physical features in the learning room?				
Response	VD	D	N	S	VS	Response	VD	D	N	S	VS
Frequency	8	15	2	56	19	Frequency	11	18	4	63	4
Percentage	8%	15%	2%	56%	19%	Percentage	11%	18%	4%	63%	4%

Table 7.17: Student Satisfaction with the Current Physical Features of the Classrooms (n=100) (See Appendix 3-C).

As can be seen in Table 6.19, the overall satisfaction level of students regarding the physical features was 67%; 29% were dissatisfied; and 4% were neutral.

Technical support in the classrooms: Part 3 of the survey measured student perceptions of technical support and to what extent they were satisfied with the current technical support provided by the University in the distance-learning classrooms. The results are as follows: Overall, most students were dissatisfied regarding the current technical support provided by the university for distance education classrooms: 74% were dissatisfied with the role of the technical assistant in solving technical problems, and 61% were dissatisfied with the amount of time taken to solve technical problems and the working orders of the equipment (Tables 7.18; 7.19; and 7.20).

Question	How satisfied or dissatisfied are you with the performance of technical assistants in terms of their ability to solve technical problems?				
Response	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
Frequency	25	49	5	12	9
Percentage	25%	49%	5%	12%	9%

Table 7.18: Student Satisfaction Regarding the Role of the Technical Assistant in Solving Technical Problems (n=100) (See Appendix 3-C).

Question	How satisfied or dissatisfied are you with the amount of time that is taken to solve these technical problems?				
Response	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
Frequency	23	38	8	20	11
Percentage	23%	38%	8%	20%	11%

Table 7.19: Student Satisfaction Regarding the Amount of Time Taken to Solve Technical Problems (n=100) (See Appendix 3-C).

Question	How satisfied or dissatisfied are you with the working order of the equipment in the distance-learning classroom?				
Response	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
Frequency	19	42	6	23	10
Percentage	19%	42%	6%	23%	10%

Table 7.20: Student Satisfaction Regarding the Working Order of the Equipment (n=100) (See Appendix 3-C).

It is not surprising that the overall satisfaction level of students relating to the current technical support was negative, with a 63% dissatisfied rate (Table 7.21).

Question	What is your overall satisfaction level with the current technical support provided in the distance-learning classroom?				
Response	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
Frequency	35	28	2	25	10
Percentage	35%	28%	2%	25%	10%

Table 7.21: Students Overall Satisfaction with the Current Technical Support (n=100) (See Appendix 3-C).

Classroom management and communication with the instructors: Part 4 of the survey measured students' perceptions about other problems they faced in the classrooms (e.g., participation and communication with the instructor and classroom management issues). The results of this section are as follows.

In terms of classroom management problems, the majority of participants (83%) agreed that the authority of the instructor was insufficient and that the behaviour of some students in the classroom (e.g., making noise, illicit talking, inappropriate movement and disturbing peers) largely affected their ability to concentrate on the instructor. There was an agreement level of 83% and 78 % respectively (Tables 7.22 and 7.23).

Question	The authority of the male instructors is insufficient.				
Response	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Frequency	6	9	2	54	29
Percentage	6%	9%	2%	54%	29%

Table 7.22: Students' Level of Agreement with the Statement 'The Authority of the Male Instructor is Insufficient' (n=100) (See Appendix 3-C).

Question	The behaviour of some students in the classroom (e.g. making noise, inappropriate movements and disturbing peers) greatly affects my ability to concentrate on the instructor.				
Response	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Frequency	8	11	3	49	29
Percentage	8%	11%	3%	49%	29%

Table 7.23: Students Level of Agreement with the Behaviour Statement (n=100) (See Appendix 3-C).

In terms of participation with instructors, the majority of students (74%) agreed that they participated more when they sat near to the microphones (Table 7.24); 81% agreed that they were not given a chance to participate with the instructors because the classroom was crowded (Table 7.25); and 89% agreed that they hesitated to participate with the instructor because he was a man (Table 7.26). 70% disagreed with the statement, "I did not attend distance-learning classrooms because I found that I couldn't engage in the classroom" (Table 7.27).

Question	<b>I am participating more when I sit near the microphones.</b>				
Response	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Frequency	9	12	5	43	31
Percentage	9%	12%	5%	43%	31%

Table 7.24: Students Level of Agreement with the Statement ‘I am Participating More When I Sit Near the Microphones’ (n=100) (See Appendix 3-C).

Question	<b>I am not given a chance to participate with the instructor because the classroom is crowded.</b>				
Response	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Frequency	7	10	2	51	30
Percentage	7%	10%	2%	51%	30%

Table 7.25: Students Level of Agreement with the Statement ‘I am Not Given a Chance to Participate with the Instructor Because the Classroom is Crowded.’ (n=100) (See Appendix 3-C).

Question	<b>I am hesitating in participation with instructor because he is a man.</b>				
Response	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Frequency	3	7	1	48	41
Percentage	3%	7%	1%	48%	41%

Table 7.26: Student Response to the Statement ‘I am Hesitating in Participation With Instructor Because He is a Man’ (n=100) (See Appendix 3-C).

Question	<b>I do not attend distance learning classes because I find that I am unable to engage in the learning environment.</b>				
Response	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Frequency	24	46	4	18	8
Percentage	24%	46%	4%	18%	8%

Table 7.27: Student Response to the Statement, ‘I Do Not Attend Distance-Learning Classes Because I Find that I Am Unable to Engage in the Learning Environment’ (n=100) (See Appendix 3-C).

Most students (68%) agreed that they could not communicate with instructors after the lectures (Table 7.28).

Question	<b>I can't communicate with the instructor after a lecture.</b>				
Response	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Frequency	8	17	7	42	26
Percentage	8%	17%	7%	42%	26%

Table 7.28: Student Responses to the Statement, ‘I Can't Communicate with Instructors After a Lecture’ (n=100) (See Appendix 3-C).

## 7.4 Results of the Students’ Preparation Survey

The purpose of this questionnaire was to explore the importance of student preparation by both the university and the male instructors in terms of reducing discipline problems in distance-learning classrooms that use video conferencing technology in KSU, and the reasons that cause female students to have discipline problems in these classrooms (See Appendix 3-M).

#### 7.4.1 Data Validation

The Students' Preparation Questionnaire was administered to 112 female students, all of whom returned it. In validating the data of these 112 questionnaires, 12 questionnaires were rejected for the following reasons.

- Nine questionnaires were returned without any response.
- One questionnaire was rejected because the participant answered only three questions.
- Two questionnaires were rejected because participant responses were inconsistent.

The remaining 100 surveys were appropriately and completely filled out by the participants, and these have been analysed.

#### 7.4.2 Reliability and Validity of the Data

To ensure the survey's reliability, 15 undergraduate female students at Mallaz Campus completed the survey and their responses were kept. After two weeks, the same students were asked to complete the survey once more. Their answers were the same in both stages, meaning that the survey was reliable. In addition, the Cronbach Alpha reliability measure was used for the numeric questions (questions 10 and 12). The results were satisfactory for these two questions with 0.83. To ensure the validity of the survey, the survey was tested with the help of a university professor who provided valuable suggestions and advice with regard to the content of the survey and the steps and procedures that had to be followed.

#### 7.4.3 Results of Students' Preparation Questionnaire

As mentioned early, the purpose of this questionnaire was to explore the importance of student preparation by both the university and the male instructors in terms of reducing discipline problems in distance-learning classrooms that use video conferencing technology in KSU, and the reasons that cause female students to have discipline problems in these classrooms. The preparation in this context related to two points: first, it was to create an awareness on the part of female students about the distance-learning technologies, e.g. why KSU uses this method in teaching female students, how it is differentiated from the traditional classroom, the advantages and limitations of this medium, etc. Second, to create an awareness on the part of the students about university rules and regulations in terms of managing student behaviour, and the consequences of breaking university rules. The results of this study will give an insight into the importance of such preparation and the current

efforts done by the university and the male instructors in this regard. It will also help us to understand the reasons behind discipline problems. The significant results of the study were as follows:

For all questions in the survey that had ‘Yes’, ‘No’ and ‘I don’t know’ responses, Table 7.29 shows the numbers and percentages of responses to each of these questions.

Survey Answers to Yes/No/I Don't Know Questions					
Question	Description	Statistic	Yes	No	I don't know
Q1	Did you attend any form of distance-learning before joining the university?	N	0	100	-
		%	0.00	100.00	-
Q2	After joining the university, were there any efforts made to create awareness among the female students about the rules and regulations of the university regarding managing the students' behaviour or what the consequences of breaking such rules?	N	0	100	-
		%	0.00	100.00	-
Q8	Were there any efforts made to create awareness among the female students about the distance-learning technologies, e.g. the advantages and limitations of these technologies, the differences between these technologies and the traditional classroom, and dealing and communicating with male instructors?	N	0	100	-
		%	0.00	100.00	-
Q10	Do you think the above-mentioned preparation (mentioned in question nine) would avert you from misbehaving in the classroom?	N	61	9	30
		%	61.00	9.00	30.00
Q12	Do you think the above-mentioned preparation (mentioned in question eleven) would avert you from misbehaving in the classroom?	N	49	16	35
		%	49.00	16.00	35.00
Q13	Do you ever have any discipline problems in these classrooms?	N	58	47	-
		%	58.00	47.00	-
Q14	Were you ever punished for this?	N	15	43	-
		%	26.00	74.00	-

Table 7.29 Survey Answers to Yes/No Questions (See Appendix 3-M).

However, as all participants answered ‘No’ to Q2, no responses have been recorded from Q3 to Q7.

For Q9 and Q11, the students were asked to rate the importance of providing such preparation from their point of view. To analyse these two questions, descriptive statistics were used (Frequency and Percentage). The results are shown in Table 7.30 and Table 7.31.

Question	To what extent do you think is it important that students are educated about the rules and regulations of the university?				
	Very Important.	Important.	Neutral	Unimportant.	Very Unimportant
Response					
Frequency	6	53	23	14	4
Percentage	6%	53%	23%	14%	4%

Table 7.30: The Importance of Educating Students about the Rules and Regulations of the University (n=100) (See Appendix 3-M).

Question	To what extent do you think is it important that students are educated about distance-learning technologies?				
Response	Very Important.	Important.	Neutral	Unimportant.	Very Unimportant
Frequency	4	73	11	9	3
Percentage	4%	73%	11%	9%	3%

Table 7.31: The Importance of Educating Students about the Distance-Learning Technologies (n=100) (See Appendix 3-M).

The results mentioned above indicate many important findings:

- All students stated that they had not been involved in any form of distance-learning prior to joining the university.
- No effort has been made by the KSU or the male instructors to create awareness among female students regarding the regulations and rules for managing discipline problems in the classroom, as reported by all students in the survey.
- No effort has been made by the KSU or the male instructors to create awareness among female students regarding the distance-learning technologies in KSU as reported by all students in the survey.
- About 59% of students rated the importance of making students aware of the rules and regulations of the university with regard to managing student behaviour as either important or very important, and about 61% of them expected that such preparation would prevent them from causing discipline problems in distance-learning classrooms.
- The majority of students (73%) rated educating students about the distance-learning technologies as important and 4% rated it as very important. However, 49% of them expected that such preparation would prevent them from causing discipline problems in distance-learning classrooms compared to 35% who answered 'I don't know' and 16 who answered 'No'.
- About 58% of participants mentioned that they caused disciplinary problems in the distance-learning classroom, and among those about 74% answered that they had never been punished for such misbehaviour compared to 26% who answered 'Yes'.
- In terms of the reasons why students make discipline problems in the distance-learning classroom, the lecturer could not see you was the most common problem according to the participants. All other reasons mentioned by female students are shown in Figure 7.4.

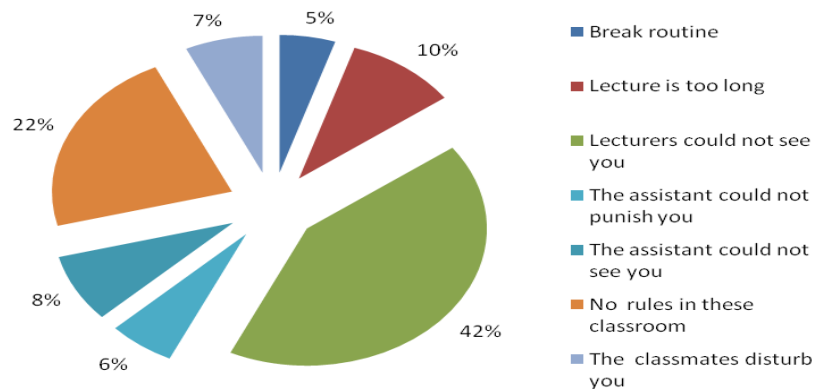


Figure 7.4: Reasons for Discipline Problems in the Distance-Learning Classrooms (n=100).

## 7.5 Results of the Teaching Assistant Study

### 7.5.1 Reliability and Validity

With regard to the reliability and validity of the teaching assistants study, triangulation was used. Triangulation is a common strategy for improving the reliability and validity of research (Patton, 2001). It is used to increasing reliability in that two or more methods of data collection are utilised in a study. In this study, data was obtained from interviews with participants as well as from observation in the classroom. The data obtained from interviews was confirmed by observation, and vice versa.

### 7.5.2 Results of the Teaching Assistant Study

The purpose of this study was to investigate the role played by teaching assistants in the distance-learning classrooms in KSU, and how they contributed to reducing discipline problems in the classroom. This study involved both interviews with female students, male instructors and teaching assistants, as well as observations as discussed before in the methods chapter (See Chapter 3.2.2.2). The results of this study were as follows, with the participants' answers being classified under the following four main themes:

- The role of the assistant in discipline problems.
- The role of the assistant in communicating with instructors.
- The role of the assistant in terms of technical problems.
- The need for the assistant.

**The Role of the Assistant in Discipline Problems:** All students were in complete agreement that the teaching assistant played a very important role in reducing discipline problems in the

classroom. Most of the students had experience of studying in this environment with and without a teaching assistant, and stated that the situation was improved by the presence of the assistant. However, students also reported that discipline problems still existed even when the assistant was present,, and that sometimes the assistant was unable to deal with them as some students did not comply with what she said. Examples of student comments were:

Student F8: “Although the teaching assistant was unable to solve all the discipline problems in the classroom, she contributed significantly in reducing these problems and we have to say thank you to the university for supplying teaching assistants...”.

Student F2: “I have experience of attending classrooms without a teaching assistant...in terms of discipline problems, you couldn’t imagine the situation...you couldn’t even hear what the instructor said...the situation was unacceptable...”.

Student F10: “There is no doubt that the teaching assistant helps in reducing discipline problems in the classroom...not only this but she also contributes to the attendance of the students at the lecture...if she is not there, you may find a classroom empty except for a few students...”.

**The Role of the Assistant in Communicating With Instructors:** The majority of students stated that the assistant played an important role in communicating with the instructor, especially outside the lecture and during exams, where the assistant helped students to contact instructors regarding any queries and informed students of any new requirements set by instructors. Examples of student answers were:

Student F3: “The only way to contact the instructor outside the lecture time is by contacting the teaching assistant”.

Student F1: “...one time, I had some important questions regarding the exam, I went to the assistant’s office and she called the instructor by phone and answered all my queries...”.

Student F7: “...through the assistant we can get the course materials and our exams results...”.

**The Role of the Assistant in Terms of Technical Problems:** All students confirmed that the teaching assistant helped solve technical problems during lectures by reporting them to the maintenance department. On most occasions she was in the classroom before class started to ensure that all the equipment was working successfully. Examples of student answers were:

Student F6: “...the assistant reported any technical problem during the lecture but sometimes the maintenance department delay in solving the problems....”

Student F4: “The assistant usually ensured that all equipment worked successfully before the lecture started.”

**The Need for the Assistant:** All students confirmed that a teaching assistant was necessary, and said that she had a key role in this environment and understood student needs more than the instructor. She ensured and noted student attendance at the lectures, and that they stayed throughout the lecture. Sometimes they encouraged students to interact with the male instructor. Examples of student answers were:

Student F9: “...yes we need the assistant and I couldn’t imagine the situation without the assistant...”

Student F11: “If the assistant was absent, students didn’t comply with class time and most of them left early...”

Student F13: “If there was no assistant, students did not remain in the lecture because of discipline problems...”.

## **7.6 Results of the CommEasy System Evaluation**

### **7.6.1 Reliability and Validity**

For the reliability and validity of the CommEasy Evaluation study, a triangulation was used. In the evaluation of the CommEasy system, data was obtained from questionnaires completed by the participants as well as from observations in the classroom. The data obtained from questionnaires was confirmed by observation and vice versa.

### **7.6.2 Results of the Evaluation of the CommEasy System**

The purpose of this evaluation was to ascertain whether or not the CommEasy helped to increase and encourage the participation of female students in the distance-learning classrooms, especially for students who were embarrassed or hesitant in speaking to the male instructors and asking questions, or not. The hypothesis was that the use of the CommEasy system would encourage and increase female students’ participation in the distance-learning classroom and solve the problems students faced in this regard. This has been tested using two methods, the comparative analysis and the questionnaire as discussed previously in the Methodology Chapter (See Chapter 3.5). The results of the evaluation were as following:

### 7.6.2.1 The Comparative Analysis

In this method, students participation have been observed for one month in 4 lectures. The lectures were held in the same distance-learning classroom, at the same time every week, on the same subject (Islamic Studies), and every lecture lasted for 2 hours. The lecture topics were almost similar, and this was chosen according to the instructor's advice. A total of 30 participants were chosen randomly from 63 students, and they freely agreed to participate in the study. The four lectures were observed over a four-week period, and the students' participation in the two conditions (without and with CommEasy) has been recorded in the table. In the weeks 1 and 2, the students participate with instructor without using the CommEasy system. At week 3 and 4, students participate with using the CommEasy system. The number of students participations has counted in each lecture. The total number of students participated in this experiment were 30. The researcher has count the number of participations each students have in every lecture. Students are coded as S1 to S30. The results of students participation in each lecture is shown in Table 7.32

Student No	Week 1	Week 2	Week 3	Week 4	After - Before
S1	0	1	3	2	4
S2	0	0	2	1	3
S3	1	0	3	4	6
S4	3	2	5	6	6
S5	2	3	3	4	2
S6	1	0	1	2	2
S7	3	4	5	7	5
S8	4	1	3	3	1
S9	2	0	3	1	2
S10	0	0	1	3	4
S11	7	4	5	3	-3
S12	0	0	0	0	0
S13	5	1	3	2	-1
S14	1	0	1	0	0
S15	0	0	2	3	5
S16	0	0	0	0	0
S17	2	1	3	6	6
S18	1	1	3	2	3
S19	1	0	4	3	6
S20	5	1	7	4	5
S21	2	1	4	3	4
S22	2	3	2	4	1
S23	1	0	1	3	3
S24	0	2	2	2	2
S25	1	3	3	5	4
S26	0	1	1	1	1
S27	2	2	4	6	6
S28	0	0	2	1	3
S29	3	2	5	5	5
S30	1	0	0	1	0
<b>Total</b>	50	33	81	87	85

Table 7.32: Number of Students Participation in Each Lecture (n=30) (Participation refers to the number of questions that students asked in the lecture, either with microphones or CommEasy).

To analysing the obtained data and test the hypothesis posed in chapter 1, a set of statistical procedures has used. These will be discussed in details below.

**Overview of Participations by Week:** the table and chart (Table 7.33 and Figure 7.5) shows the mean and median participations by week. As the intervention began in week three, the data shows an expected trend with a steep increase in participations between weeks two and three.

Mean and Median Average Participations by Week				
Week	n	Mean	Standard Deviation	Median
Week 1	30	1.67	1.77	1
Week 2	30	1.10	1.27	1
Week 3	30	2.70	1.70	3
Week 4	30	2.90	1.92	3

Table 7.33: Mean and Median Average Participations by Week (n=30).

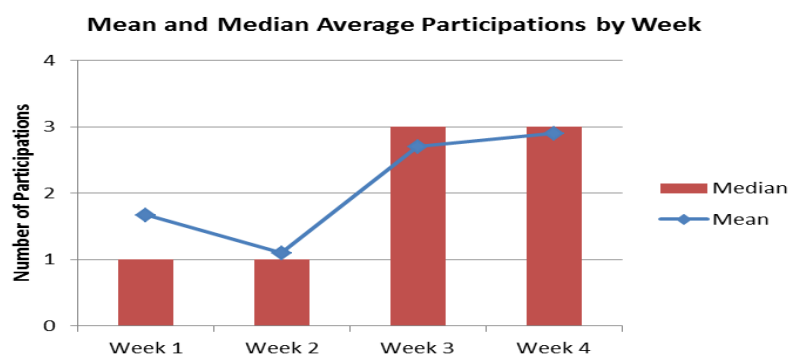


Figure 7.5: Mean and Median Average Participations by Week (n=30).

It can be concluded from these results that student participation in weeks one and two differed from that in weeks three and four. However, to formally test the hypothesis posed in chapter 1, a set of statistical tests can be used, such as a Repeated Measures ANOVA or a paired t test. Both tests look at the changes in levels of a measurement that occurs more than once for the same group. In this study, the comparison looks at how the same student may have differed in their participation over time, with and without the CommEasy system.

Repeated Measures ANOVA is preferable for comparing the changes in measurement occurring at three or more points in time while the paired t-test can be used if two points in time are to be investigated. However, as the aim of this study was to compare the level of student participation in weeks 1 and 2 with their level of participation in weeks 3 and 4, the paired t-test was the most appropriate to apply. The process of how this test was used is discussed below.

**T-Test Comparing Weeks 1 and 2 With Weeks 3 and 4:** As the participations in weeks 1 and 2 are different from those in weeks 3 and 4, it is possible to combine each of the pairs of

weeks to create single measurements for ‘before’ and ‘after’. To do this, the number of times each student participated was added for weeks 1 and 2 (before) and, similarly, for weeks 3 and 4 (after). The Table 7.34 below shows the mean and median values for the combined pairs of weeks. This table also shows the difference between the weeks. This is calculated by subtracting the number of participations in the ‘before’ weeks from the number of participations in the ‘after’ weeks (Table 7.34). This difference variable is the one that will be tested in the paired t-test.

Mean and Median Average Participations by Before and After				
Time	n	Mean	Standard Deviation	Median
Before (Weeks 1&2)	30	2.77	2.67	2
After (Weeks 3&4)	30	5.60	3.32	5
Difference (After-Before)	30	2.83	2.41	3

Table 7.34: Mean and Median Average Participations by Before and After.

However, there is an assumption of normality in parametric testing procedures. Therefore, it is preferable that the difference variable is normally distributed (or at least, not different enough from normality to be problematic).

The way of formally testing the normality is to use a normality test, as discussed earlier in this chapter, such as Shapiro Wilks or Kolmogorov-Smirnov. The results of both tests has showed that the Differences variable follows normal distribution. Therefore, it is safe to use the paired t-test ( $p > 0.05$ ).

The results of the paired t-test are shown below (Table 7.35). This test indicates a very significant difference between Weeks 1-2 (Before) and Weeks 3-4 (After) ( $p < .0001$ ). Thus, it can be concluded that there was a very significant increase in participation in Weeks 3-4 compared to Weeks 1-2. According to these results, the null hypothesis, which states that female students’ participation with male instructors in distance-learning classrooms will be the same with and without the use of CommEasy, has been rejected. The hypothesis posed in Chapter 1 has been accepted, which states that female students’ participation with male instructors in distance-learning classrooms will be increased using the CommEasy system, compared with not using CommEasy.

Paired T-test Results Comparing the Difference in Scores Between Weeks 3-4 and Weeks 1-2									
Number of Subjects	Mean of Difference	Standard Deviation	Minimum Difference	Maximum Difference	95% Confidence Limits of Mean Difference		Degrees of Freedom	t Value	t Prob.
30	2.83	2.41	-3	6	1.93	3.73	29	6.44	<.0001

Table 7.35: Paired T-test Results Comparing the Difference in Scores Between Weeks 3-4 and Weeks 1-2

### 7.6.2.2 The Result of the Survey

**Student Questionnaire:** After the experiment was completed, the same students were requested to fill in an online questionnaire to identify their opinions regarding the CommEasy system and to identify to what extent this system help to solve the problems they faced in participation with a male instructor. This questionnaire was very useful to identify how students perceive the CommEasy system in terms of support for their participation and communication with male instructors. The questionnaire allows further to evaluate the system according to number of metrics such as ease of use, ease of download, GUI etc. To analyse the results of the questionnaire, a descriptive statistics (Frequency and Percentage) has been used. In general, the results obtained give a good indication of the positive impact that the system has in solve the communications and participations problems that students were faced and support their participation with male instructors. All the results presented in Table 7.36.

<table border="1"> <thead> <tr> <th>Question</th> <th colspan="5">The system provides a convenient way to communicate with male instructors in the distance-learning classroom.</th> </tr> </thead> <tbody> <tr> <th>Response</th> <th>SD</th> <th>D</th> <th>N</th> <th>A</th> <th>SA</th> </tr> <tr> <td>Frequency</td> <td>2</td> <td>6</td> <td>1</td> <td>11</td> <td>10</td> </tr> <tr> <td>Percentage</td> <td>7%</td> <td>20%</td> <td>3%</td> <td>37%</td> <td>33%</td> </tr> </tbody> </table>	Question	The system provides a convenient way to communicate with male instructors in the distance-learning classroom.					Response	SD	D	N	A	SA	Frequency	2	6	1	11	10	Percentage	7%	20%	3%	37%	33%	<table border="1"> <thead> <tr> <th>Question</th> <th colspan="5">The system provides a convenient way to pose questions for instructors during the lecture.</th> </tr> </thead> <tbody> <tr> <th>Response</th> <th>SD</th> <th>D</th> <th>N</th> <th>A</th> <th>SA</th> </tr> <tr> <td>Frequency</td> <td>1</td> <td>3</td> <td>0</td> <td>15</td> <td>11</td> </tr> <tr> <td>Percentage</td> <td>3%</td> <td>10%</td> <td>0%</td> <td>50%</td> <td>37%</td> </tr> </tbody> </table>	Question	The system provides a convenient way to pose questions for instructors during the lecture.					Response	SD	D	N	A	SA	Frequency	1	3	0	15	11	Percentage	3%	10%	0%	50%	37%
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Frequency	2	8	4	13	3																																												
Percentage	7%	27%	13%	43%	10%																																												
Question	I can participate easily in the crowded classroom using CommEasy system.																																																
Response	SD	D	N	A	SA																																												
Frequency	0	3	1	19	7																																												
Percentage	0%	10%	3%	64%	23%																																												

<b>Question</b>	<b>I can participate easily even if I sit far from microphones.</b>				
<b>Response</b>	SD	D	N	A	SA
Frequency	2	2	4	14	8
Percentage	7%	7%	13%	46%	27%
<b>Question</b>	<b>The system is easy to download (application loads quickly and does not crash)</b>				
<b>Response</b>	SD	D	N	A	SA
Frequency	0	1	1	17	11
Percentage	0%	3%	3%	57%	37%
<b>Question</b>	<b>The system is easy to run (account can be created easily and quickly)</b>				
<b>Response</b>	SD	D	N	A	SA
Frequency	0	3	2	16	9
Percentage	0%	10%	7%	53%	30%
<b>Question</b>	<b>The system is easy to use (you can launch and navigate within the app easily)</b>				
<b>Response</b>	SD	D	N	A	SA
Frequency	0	0	1	25	4
Percentage	0%	0%	3%	83%	14%
<b>Question</b>	<b>The GUI is user-friendly (allowing you to interact with the application in a natural and intuitive way).</b>				
<b>Response</b>	SD	D	N	A	SA
Frequency	1	1	5	19	4
Percentage	3%	3%	17%	64%	13%
<b>Question</b>	<b>The Help of the system is informative (the system's help page provides useful information).</b>				
<b>Response</b>	SD	D	N	A	SA
Frequency	1	3	3	16	7
Percentage	3%	10%	10%	54%	23%

Table 7.36: The Results of Students' Questionnaire (n=30).

For the question 'What aspect(s) of the CommEasy system did you like/dislike?', students who answered this question mentioned that they liked most of the current functionalities provided by the system. They mentioned that they very much appreciate the anonymity feature of the system as they can ask whatever they want to instructor. Some of them mentioned that they were shy and hesitating to ask questions using the microphones because they were required to say their names and they worry that they might be labelled as incapable by the instructor. They also mentioned that they worried because of their peers look to them. However, students did not mentioned any aspects that they were not satisfied with.

For the question 'Would you like to add any further comments?' students mentioned that they hope the system become available in the Apple Store and used by all their male instructors instead of traditional methods of communication.

**Instructor Questionnaire:** the instructor was given a similar questionnaire to the one give to the students to identify how he perceive the system and to explore any comments he might have to improve the system. The instructor was agreed with all the items mentioned in the questionnaire. The instructor further commented that he found this system to be an excellent endeavour to support communication and interaction in the classrooms. He mentioned that the value of the system is that it is in line with the current trend in Saudi Arabia that dominate the using of smart devices that almost being owned by most if not all university students and

that become a part of their everyday life. He mentioned that it is preferable if the system improved to support additional mobile platforms in addition to iOS platform.

In summary, the result of the questionnaires is supported the result obtained in the experiment and support the hypothesis posed at the beginning of this research.

### **7.7 Summary**

This chapter presents the results of the thesis. The next chapter will discuss these results and will propose some solutions for the common problems students faced in distance-learning classroom.

# 8 Discussion

This chapter discusses the results presented in Chapter 7. Through such discussion, all components of the distance-learning classrooms in KSU will be evaluated using the strategies provided in Chapter 5 (See Appendix 5-C, Strategies for Effective Designing of the Distance-learning Rooms). All the problems that exist in the current learning environment, including the problems reported by female students in the survey, will be considered in this chapter and feasible solutions for all of these problems will be proposed accordingly. It is worth mentioning that all solutions proposed in this study have been based on the fact that KSU currently has a sufficient budget to apply these solutions as discussed earlier in this thesis. These solutions will be combined to produce a proper new physical design for the distance-learning classrooms that can be followed in KSU as well as internationally. A conclusion of the study, along with limitations and suggestions of the further research, will be given in the next chapter.

## 8.1 Classroom Equipment Arrangements

Part I of the survey was used to identify students' perceptions regarding classroom equipment arrangement and to what extent they were satisfied or dissatisfied with the current arrangements.

### 8.1.1 Microphones in the Classroom

**Results of the Survey Regarding Microphones in KSU:** As presented in the previous chapter, the majority of participants were dissatisfied regarding the number of microphones as well as their locations with 74% and 89 % respectively. However, 25% were satisfied with the number of microphones in the classroom.

**Feasible Solutions for Problems Related to Microphones in KSU:** There are four microphones spread out on both sides of the classroom, as shown in Figure 8.1 and as mentioned in the description of the distance-learning environment in KSU (See Chapter 4.2).

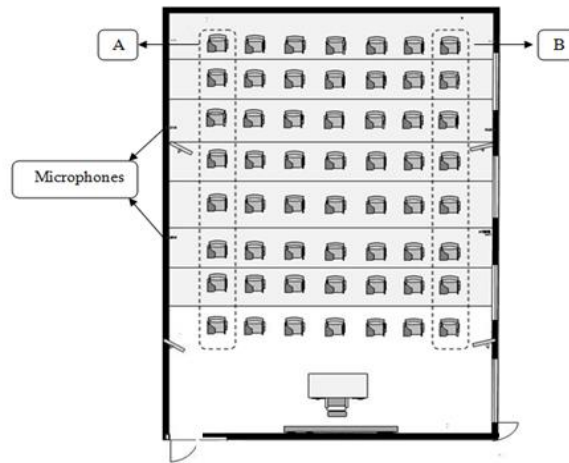


Figure 8.1: Distance-Learning Classroom Layout in KSU

The majority were dissatisfied with the number of these microphones as well as with access to them. As shown in Figure 8.1, the students who sit in seats (A) or (B) are able to access microphones more easily as they are sitting nearest, and such students appear to be satisfied with the current status of microphones in the classroom (the results indicated that 25% were satisfied with number of microphones, as stated previously). However, this is not the case for students who sit at other seats in the classroom, especially if the classroom is crowded, because the students' movements are more difficult and therefore reaching the microphones is not so easy. This problem was also confirmed by the participants in the last part of the survey where the majority agreed that they usually participate more when they sit closer to the microphones. They also mentioned that they could not participate when the classroom was crowded because they faced problems in reaching the microphones, as will be discussed later in this chapter.

To solve these problems, the effective strategies for designed microphones in the distance-learning room that were produced in chapter 5 (Str1-Str11; See Appendix 5-C) have been used. For each strategy, it has been investigated whether or not the KSU matches its requirements and if not, what solutions should be implemented by KSU. For example, in terms of the above-mentioned problems reported by students in the questionnaire - number of microphones and its locations, Str1 states that microphones should be placed no more than 2 ft. from each student. However, this is not the case in KSU. In the current classroom layout the distance between students and microphones is more than 2 ft. The distance between students who sit at seats in (A) or (B) and the microphones is approximately 3.28 ft., while the distance of students in other positions in the classroom will certainly be more than 3 feet (See Figure 8.1). However, students should walk to the microphones when they want to

communicate with instructor and this is unfeasible especially in crowded classroom. This means that the current layout of classroom should be reconsidered in KSU and the number of microphones, as well as their locations should be improved, so that the distance between microphones and students is no more than three feet and where all students can access microphones easily, regardless of whether the classroom is crowded or not. Therefore, Str1 to Str11 leads to the following feasible solutions that KSU is advised to follow to improve its current distance-learning rooms: increase the number of microphones in the classroom to 27 microphones (every 2 to 3 students will share one microphone in this case), choose hypercardiod adjustable gooseneck microphones with an automatic mixer (which will switch off all microphones except for the one in use) and mount these microphones on students' desks for better access and better sound quality.

To summarise, the solutions mentioned above can contribute to solving the problems associated with microphones in the distance-learning classroom in KSU.

### 8.1.2 Screens in the Classroom

**Results of the Survey Regarding Televisions in KSU:** As presented in the previous chapter, the majority of students (67%) were satisfied with the number of screens, compared with the 27% who were dissatisfied. In terms of the location of the televisions in the classroom, 73% of the students were satisfied. On the other hand, size of the screen as well as clarity of images was a source of dissatisfaction for the vast majority of students (93% and 90% respectively).

**Feasible Solutions for Problems Related to Televisions in KSU:** There are four 21-inch Panasonic televisions spread out on both side of the classroom, as shown in Figure 8.2 and as mentioned in the description of the distance-learning environment (See Chapter 4.2). The height of each is 18.4 inches and the width is 20.2 inches.

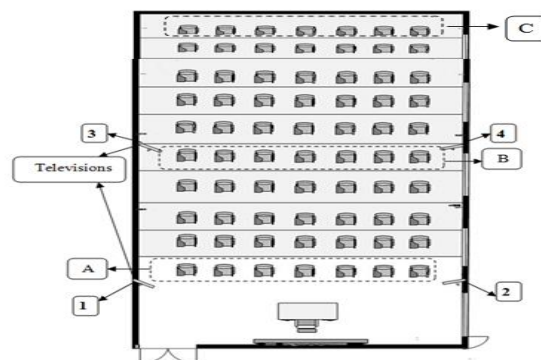


Figure 8.2: Distance-Learning Classroom Layout in KSU

As identified previously with the microphones, the effective strategies provided for designing the display devices in the distance-learning rooms produced in chapter 5 will be used to evaluate the current design of screens in KSU and propose feasible solutions for problems accordingly. For Str12 to Str14 that related to the number of televisions in the classroom, KSU include 4 televisions and strategies state there must be 2 or more, therefore, KSU met this requirement. However, 27% of students were dissatisfied with the number of televisions, and those might have been the students who sit in back rows of the classroom. Such students face difficulties in seeing the screens due to the distance between them and screens, as will be discussed later. Increasing the size of the screens could solve such problems.

For Str15 to Str18 that related to the size of the televisions, KSU did not meet the requirements and this component left the majority of female students dissatisfied as stated previously. These problems can be solved by staying with the current number and locations of televisions used in the classroom and increasing their size. According to Str17, the size of the televisions should be one inch for each foot of distance between the most distant student and the screen. In the KSU, there are 4 televisions as mentioned previously, coded as 1,2,3,4 in Figure 8.2. In terms of television 1 and 2, the distance between televisions and the most distant students (students who sit in row B, directly before televisions 3 and 4) is approximately 8 feet, which means that the current size of the televisions is considered acceptable. However, in terms of televisions 3 and 4, the distance between those screens and students in row C is approximately 27 feet, which means that the current screen size is less than the required size, which is supposed to be at least 27 inches. This could be an important reason why students are dissatisfied with the current screen size. However, as mentioned in Str18, larger screen sizes are better as they allow students to be more comfortable and feel more in touch with their instructors.

For Str19 to Str22 that related to the locations of televisions, KSU met these requirements, the current televisions located about 6.3 feet from the floor, so the new televisions should be placed in the same locations.

For Str23 relating to image quality, KSU did not meet the requirements and the majority of students were also dissatisfied regarding this component as mentioned in the survey. According to many researchers, the latest versions of televisions, such as auxiliary flat-panel HD televisions, provide better quality pictures than old CRT generations. However, at most universities worldwide, auxiliary flat-panel HD televisions have replaced the CRT

televisions. Therefore, KSU is advised to replace the current CRT televisions with auxiliary flat-panel HD televisions.

Therefore, following Str12 to Str23 leads to the following feasible solutions that KSU is advised to follow to improve its current televisions used in distance-learning rooms: Replace all the current televisions with a flat-panel HD televisions and increase the size of televisions 3 and 4 to be at least 28 inches.

To summarise, the solutions mentioned above can contribute to solving the problems associated with televisions in the distance-learning classroom in KSU.

### 8.1.3 Loudspeakers in the Classroom

**Results of the Survey Regarding Loudspeakers in KSU:** As presented in the previous chapter, the majority of students (65%) were satisfied with the loudspeaker arrangement in the classroom. However, 30% were dissatisfied with the loudspeaker arrangements in the classroom.

**Feasible Solutions for Problems Related to Loudspeakers in KSU:** Even though the majority of students were satisfied with the current arrangement of loudspeakers in KSU, nearly a third (30%) were dissatisfied. However, following Str24 to Str30 for effective design of the loudspeakers in the classroom has highlighted some problems in the current design and therefore recommended some feasible solutions accordingly. Str24 states that any learning room with more than 85 students should have a voice amplification system and KSU did not meet this requirement, the current distance-learning classroom accommodates up to 100 female students with no separate loudspeakers provided other than the built-in speakers in the televisions. Therefore, following Str24 to Str30 leads to the following solutions that KSU is advised to follow to improve the distance-learning classroom: use four ceiling-mounted loudspeakers. These loudspeakers should have a uniform response frequency and a wide covering angle (more than 140°).

## 8.2 Classroom Physical Features

Part II of the survey identified students' perceptions regarding the classroom physical features and to what extent they were satisfied or dissatisfied with the physical features of the classroom. The results were presented in the previous chapter and will be discussed in this section.

**Results of the Survey Regarding Classroom Physical Features in KSU:** As presented in the previous chapter, most physical classroom features were satisfactory for students. The total percentage of students who were either satisfied or strongly satisfied ranged between 54% and 75%. However, for some of these features, such as the size of the learning room, number and width of aisles, noise level in the classroom, lighting, ceiling, ventilation, air-conditioning, temperature and door of the learning room, approximately 25% to 30% of students were dissatisfied. Evaluating such features with the strategies produced in Chapter 5 (See Appendix 5-C) has shown problems in some cases, such as doors, lighting and noise level, while others are fine, as will be discussed later. In addition, the results showed that 39% of students were dissatisfied with the curtain in the classroom, 37% were dissatisfied with student chairs, 36% were dissatisfied with the floor and 35% were dissatisfied with the acoustics. Evaluating those features revealed that there were problems in these four components, and the feasible solutions will be provided accordingly.

There were some features with which the majority of students were dissatisfied, such as the size of the windows and their locations and number (71%, 62% and 59%, respectively). In addition to that, for two features (the student's desk and the colour of the learning room), the total number of satisfied students is close to the number of those dissatisfied, 47% were satisfied and 45% dissatisfied while the remaining 8% were neutral. The same was true for the colour of the learning room with 49% satisfied and 47% dissatisfied while the remainder were neutral.

The overall satisfaction level of students toward these features was 67% satisfaction comparing to 29% dissatisfied. However, the dissatisfaction components and all existed problems will be investigated here to propose feasible solutions. For all these problems, the strategies produced in Chapter 5 (Str34 to Str156) will be followed to propose feasible solutions for these current problems. However, due to the large number of strategies for designing classroom physical features (more than one hundred), the next section will directly summarise the problems existed in KSU and the feasible solutions for these problems will be given without discussing every strategy in detail.

**Feasible Solutions for Problems Regarding Classroom Physical Features in KSU:** As stated before, students were dissatisfied with the number, location and size of the windows in the distance-learning classroom in KSU. In these classrooms, one side of the room includes nine large windows, which are covered by white vertical window blinds (Figure8.3). These windows overlooked the university yard, which was usually full of students and considered a

source of noise throughout the day; this could be an important factor in making students dissatisfied about the location of these windows. However, the level of noise will definitely increase when the windows are open. In addition, these windows are a source of natural light, which of course affects the level of lighting in the classroom.



Figure 8.3 Windows in Distance-Learning Classroom in KSU

However, following the strategies Str93 to Str102 for effective designing of windows in the distance-learning classroom leads to the following solutions: KSU is advised that if possible the distance-learning classroom should not include any windows. If this cannot be achieved, the current windows used in the distance-learning classroom should be covered with darkening roller shades, such as Draper Dual Roller Flexshades, to allow the distance learning room to be completely darkened and at the same time minimise noise in the classroom. In addition to the problems related to windows that were discussed above, there are many other problems, related to the classroom's physical features in KSU, that have been identified by evaluating the current distance-learning classroom's physical features, with strategies produced in Chapter 5. These problems along with feasible solutions are summarised in Table 8.1:

Physical Feature	Current Problem	Solutions
Location of the learning room	Classroom located in the second floor of the building, away from building entrance/exit and students can reach classroom through stairs only.	KSU is advised to add lifts to the building to allow student to access classroom easily, especially those in wheelchairs.
Door of the classroom	Classroom has only one door.	KSU is advised to have two doors as this will be beneficial in facilitating students' movements and accommodating movements of classroom equipment into and out of the room.
	The door is located at the front of the room	KSU is advised to locate the door(s) either at the side, or rear of the room because this would help latecomers enter and get a seat without disturbing the work of the rest of the class and so makes the movement of students easier and much less noisy.
	No vision panel attached on the door	KSU is advised to attach vision panels with minimum of 2 sq. ft. at eye level on doors.
	No electric-powered door opener is use	KSU is advised to use an electric-powered door opener for easier access of students with disabilities.
Floor of the learning room	Floor made of concrete and no covering used in the classroom	KSU is advised to use a carpet in distance-learning room. Carpet is provide valuable acoustical features to the room and minimizes sound-related problems such as reflections etc.
		KSU is advised to avoid too light or too dark carpet colour because it will quickly look dirty.
		KSU is advised to choose medium to light carpet colour.
Wall of the classroom		KSU is advised to make sure that walls are designed with Sound Transmission Coefficient (STC) ratings of

		50 to efficiently decrease or block the intruding noise.
Colour/Finishes of the classroom	The colour of walls is bright yellow	KSU is advised to use neutral colours such as light blue or gray.
Windows in the classroom	The windows are very large and overlook the university yard, which was usually full of students and considered a source of noise throughout the day	KSU is advised that windows be located away from walls that are near noisy sources (such as fans, pedestrian walkways etc.).
		KSU is advised to minimise the amount of glass surfaces used in windows.
		KSU is advised to use room darkening roller shades, such as Draper Dual Roller Flexshades, to allow the distance-learning room to be completely darkened.
		The window coverings can be manually operable if windows accessible; if not, coverings should be motorized with controls easily accessible.
Student's Desks and Chairs in the Classroom	The classroom uses tablet-arm seats.	KSU is advised to use continuous work surfaces instead of tablet-arm seats.
		KSU is advised to provide 18 to 20 sq. ft. of floor space for each student.
		KSU is advised to provide each student with a work surface of about 4 sq. ft. of usable space in one unobstructed area.
		It is recommended that KSU provide unobstructed knee clearance space beneath work surfaces that are above 27".
		KSU is advised to provide appropriately sized workstations (at least 36 inches wide) for students in wheelchairs.
		KSU is advised to provide at least 2 workstations for

		students in wheelchairs.
		KSU is advised that students are provided with comfortable seats that offer them excellent ergonomics.
		For seat spacing, KSU advised to provide a minimum of 28" on centre in the learning room with movable desk or with continuous work surfaces.
Lighting in the classroom	Fluorescent light fixtures produce large amount of noise in the classroom.	KSU is advised that all fluorescent light fixtures should be checked regularly by an electrician to determine the reasons for such problems and fixed or replaced these.
Heating Ventilation and Air Conditioner	The ventilation system produces noise in the classroom.	KSU is advised to choose noise-controlled (HVAC) systems as this will have a large impact on the reduction and elimination of noise.
Acoustics and Noise in the classroom		<p>KSU is advised to meet the following international guidelines:</p> <ul style="list-style-type: none"> <li>- The overall noise level in empty rooms should be less than NC 35. This level should be met even when the air conditioning, ventilation and heating systems are operating.</li> <li>- Meet 0.75 reverberation time</li> <li>- signal-to-noise ratio should be +15dB above the background noise</li> <li>- Use quiet fans and duct insulation to reduce the noise level of HVAC systems</li> <li>- Use other supported devices such as background noise cancellers, if required.</li> </ul>

Table 8.1 Problems Related to Classroom Physical Features along with its Possible Solutions  
To summarize, the previous solutions can contribute to solving the problems related to the physical classroom features in KSU.

### 8.3 Technical Support in the Classroom

Part III of the survey identify students' perceptions regarding the technical support and to what extent students were satisfied or dissatisfied with the current technical support provided by the university in the distance-learning classrooms.

**Results of the Survey Regarding Technical Support in KSU:** Overall, the majority of students were dissatisfied regarding the current technical support provided by the university in the distance-learning classrooms: 74% were dissatisfied with the role of the technical assistant in solving technical problems, and 61% were dissatisfied with the amount of time taken to solve technical problems and also with the working order of the equipment. A total of 31% of students were satisfied with the time taken to solve technical problems and 33% were satisfied with the working order of equipment, indicating that sometimes there is an acceptable level of technical support provided to these classrooms. However, this requires improvement as the majority of students were dissatisfied. It is therefore not surprising that the overall satisfaction level of students with the current technical support was 63% dissatisfied and 35% satisfied.

**Feasible Solutions for Problems Related to Technical Support in KSU:** As stated before, majority of students were dissatisfied with the technical support provided by university for the distance-learning classroom. To propose feasible solutions that can be used by KSU to improve its technical support, the strategies produced in Chapter 5 will be used. Following Str175 to Str166 leads to the following guidelines that KSU is advised to meet:

- 1- Activate a maintenance agreement for classroom equipment with a maintenance provider.
- 2- Use the help desk on the female campus and provide effective ways for contacting the help desk staff; for example, by telephone, email, and a website.
- 3- The help desk contact information should be easily obtained; e.g. add this information to the back of the university card.
- 4- Provide students with a way to report technical problems via the internet; e.g., provide a form on the university website that allows students to provide details of the problem they have faced/are facing and to send it to the maintenance department.

- 5- Use issue tracking system software, which is an effective way to deal with and solve technical problems.
- 6- Check the distance-learning classroom equipment at least once a week to ensure that it is in full working order.
- 7- Increase the number of female technical assistants on the female campus to eliminate the need to wait for male assistants to carry out maintenance.
- 8- The technical assistants should be well-qualified (e.g. have a degree in computer science or a computer-related field).
- 9- It is preferable that the technical assistants have basic experience in the field of maintenance, student support and computer software and hardware (at least two years' experience is recommended).
- 10- It is preferable that the technical assistants have good oral and written communication skills in addition to skills in how to deal with different users, and the ability to handle stress. These skills are essential when dealing with members of the university who are having technical problems.
- 11- It is preferable that the technical assistants have good skills in terms of problem solving.
- 12- It is recommended to provide female students with a way to complain in case they need to do so; e.g. install a complaints box outside each classroom and deal with these complaints in an appropriate way.

These recommendations can help to improve technical support in distance-learning classrooms in KSU.

#### 8.4 **Classroom Management and Communication with Male Instructors**

Part IV of the survey identify students' perceptions regarding the classroom management, communication and participation with male instructors. The results of this section were presented in the previous chapter and will be discussed in this section.

**Classroom Management:** the majority of participants (83%) agreed that the authority of instructor was insufficient and that the misbehaviour of some students in the classroom (e.g., making noise, illicit talking, inappropriate movement, and disturbing peers) significantly affected their ability to concentrate on the instructor with an agreement level of 78%.

**Feasible Solutions for Classroom Management Problems:** it is important to mention that dealing with and reducing discipline problems in the classroom is an integrated process

involving students, instructors, technology, university as well as female teaching assistants. In order to propose feasible solutions for the current classroom management problems in KSU, the list of strategies that were produced in Chapter 5 (Str167 to Str180) has been used and combined with the results of the two studies conducted in this research: the first study was about the importance of students' preparation in reducing discipline problems in the distance-learning classroom and the second study was about the role of female teaching assistants in reducing discipline problems in the distance-learning classroom. The results of these studies have been presented in the results chapter (See Chapter 7.4 and Chapter 7.5). Using these methods has resulted in classification of the solutions for classroom management problems under two main headings: role of the university and role of the instructor. KSU is advised to:

- Appoint teaching assistants for the distance-learning classroom to reduce discipline problems in the classroom.
- Provide the teaching assistants with appropriate training and support (e.g. workshops to improve their skills in managing order in the classroom).
- Organise an induction program at the beginning of each term to provide female students with basic understanding of the distance-learning environment,
- Encourage students to improve their listening skills and provide them with appropriate support and training in this regard.

The instructor is encouraged to:

- Create or build a classroom community from the beginning of a course.
- Send a welcome letter to the students at the first lecture to introduce himself, explaining the aims of the course, what will happen during the term, what topics will be covered, how students will be assessed, the rules that students should be aware of, and what will happen if such rules are broken.
- Involve students in some activities, in order to allow them to get out of the routine, and to renew their energy during classes.
- Learn students' names or have an attendance list and try to call on them during lectures to ensure that they stay involved in the classroom.
- Ask students to interact in class, give them feedback and comments regularly, as this will reduce their feelings of isolation, and encourage their communication with the lecturer.

- Alter and improve teaching approaches, and apply new strategies and approaches to manage the teaching-learning process.
- Give rules and apply the appropriate punishments when required.
- Inform students that the sound system will cut off the speaker's transmission when someone talks during lectures, and that the on/off switch can be used during lectures to eliminate or reduce discipline problems.
- Use some new technologies, such as the CommEasy system developed in this research. Such systems allow instructors to keep students involved in useful discussion: asking questions for instructors and answering questions posed by instructors through the lectures; this will help to keep student attention during lectures and reduce discipline problems as reported by many researchers and as observed during the experiment conducted in this research.

Finally, it is important to mention that understanding the reasons behind discipline problems will help in dealing with and reducing these types of problems. According to the results of the behaviour questionnaire presented in Chapter 7.4, the most common reason for discipline problems was that "The instructor could not see me." Other reasons include: lectures are too long, the assistants could not observe me and there are no rules in the classroom. Such reasons should be given more thought by both researchers and decision makers in the university and more investigation should also be done in this area to understand those reasons and propose solutions accordingly.

**Communication and Participation with Male Instructor:** Communication and Participation with a Male Instructor: The majority of students (73%) agreed that they participated more when they sat near the microphones. Fully 81% agreed that they were not given a chance to participate with the instructors because the classroom was crowded, and 89% agreed that they hesitated to participate with the instructor because he was a man. In addition, 68% of students agreed that they could not communicate with instructors after the lectures. However, 70% disagreed with the statement, "I did not attend distance-learning classrooms because I found that I couldn't engage in the classroom.", compared with the 26% who were agreed.

**Feasible Solutions for Communication and Participation Problems:** as presented in the results above, there are many factors that negatively affected the communication and participation between female students and male instructors in distance-learning classrooms such as the classroom layout, the equipment arrangement, the crowdedness of the classroom,

etc. However, increasing the number of microphones and improve the classroom layout as discussed as the beginning of this chapter can play an important role in reducing these problems and allow female students to participate with male instructors.

Another sufficient solution that has been implemented in this thesis is by introducing a new technology that can be used to deal with all these problems and support and enhance participation with instructors in the distance-learning classrooms. An innovative interactive communication system (CommEasy) has developed as presented early in chapter 6. The system has also evaluated in the distance-learning classrooms through conducted a quasi-experiment as well as a questionnaire as presented in Chapter 7.6. The results of the experiment show that using of the CommEasy system has led to increase level of participations of female students in distance-learning classrooms. Supporting and increasing students' participation in the classroom is a prerequisite for learning, and promotes many characteristics of effective learning such as increased attention, motivation and satisfaction on the part of both instructors and students (Butler, 1992; Steinert and Snell, 1999). Many educational researchers have asserted the importance of this component in supporting the teaching-learning process. Examples of these are as follows:

- It has been reported that students who are actively involved and who participate in the classroom will learn more than those who are passive recipients of knowledge (Kraft, 1985; Murray, 1991; Butler, 1992; Feden, 1994).
- It has been reported that increasing participation and engagement in the classroom can lead to increased motivation and can stimulate interest and help to maintain attention, and that all of these are essential ingredients for learning (Gage and Berliner, 1991; Meyers and Jones, 1993; Mannison et al., 1994).
- It has been reported that interactive lectures that involve high levels of interaction and participation promote a 'higher level' of thinking, and facilitate many important skills such as problem-solving, decision-making and communication skills (Michaelsen et al., 1982; Lowman, 1984; Ramsden, 1992).
- It has been reported that interactive lectures that involve high levels of participation between students and instructors, e.g. asking question by students and receiving answers from the instructors, posing questions to students in the form of quizzes and receiving feedback of the results, has numerous advantages for both students and instructors: it allow instructors to evaluate how the information has been assimilated

by students, and allows students also to obtain feedback on their knowledge and performance (Lowman, 1984; Jason and Westberg, 1991).

In addition to that, the results of the questionnaires have confirmed the results of the experiment, showing the positive impact of the CommEasy in supporting participation and communication in the classroom and solving the problems reported by female students in the survey. The majority of participants (70%) agreed that CommEasy provided them with a convenient way of communicating with male instructors in the distance-learning classroom: 87% and 76% of the participants agreed that CommEasy provided them with a convenient way of posing questions for the instructors and to answer instructors' questions, respectively. In terms of the role of CommEasy in solving the problems reported by female students in this thesis, the results of the questionnaires show that 67% of the participants agreed that they no longer felt embarrassed or hesitant when communicating with male instructors, using the CommEasy system. 87% reported that CommEasy allows them to participate easily in crowded classrooms; 73% reported that CommEasy allows them to participate easily, even if they sit far away from the microphones, and 53% reported that CommEasy allows them to communicate easily with instructors out of the classroom. In reality, 83% of participants confirmed that they participated more when they used CommEasy. This indicated the value of the CommEasy in solving all the communication and participation barriers that female students faced in distance-learning classrooms, such as hesitating when communicating with male instructors, crowding in the classroom, shortages in the numbers of microphones, communication with male instructors after lectures, etc. In addition, 53% agreed that they feel more engaged and interested in the learning environment when using CommEasy.

However, it is worth mentioning that about 27% to 34% of students did not perceive CommEasy as a convenient way to communicate with male instructors in the classroom or after the class, and they still felt embarrassed and hesitated to communicate with instructors using CommEasy. Moreover, they did not feel interested or engaged when using CommEasy. This might be related to psychological reasons. As mentioned earlier, female students were not used to dealing with male instructors, having spent more than 18 years studying in a completely segregated learning environment. Thus, those students did not prefer to participate with a male instructor with or without CommEasy. Instead, they preferred face-to-face classroom with female instructors, as stated in Chapter 7 (See Chapter 7, Table 7.3).

In addition to that, the majority of participants, (above 70%), agreed that CommEasy is easy to download, run and use. All GUI of the application is user-friendly and the Help function of

the system is informative. In addition to the female students' comments, the male instructor also commented that he finds this system an excellent endeavour in supporting communication and interaction in the classroom.

It can be concluded from the above-mentioned discussion that CommEasy is an important feasible solutions that could be used to increase the level of students' participation and interaction in the classroom; and to solve the communication and participation barriers faced by students in this regard. However, other similar PRS technologies can be also used to support communication and participation in the classroom, but it recommended by this thesis to follow these steps for a successful applying of any new technology in the classroom

- The technology should be ready to use in the classroom.
- The technology should be supported with an easy to use interface to encourage instructors and students to use it.
- The technology should be combined with a detailed documentations regarding setup, using etc.
- The technology should be combined with appropriate technical support as it is an essential part of the success of the applied technology.
- The users (instructor and students) should be provided with an adequate training as it is important to the successful of new technologies.

In summary, CommEasy has proved to be a valuable solution for enhancing communication and participation in distance-learning classrooms, and for solving the problems that female students face in this regard.

### **8.5 New Classroom Physical Design**

Applying the abovementioned solutions to the current distance-learning classroom at KSU has resulted into new classroom physical design (layout) that KSU is advised to apply. The new features related to equipment arrangement and physical features has been summarised in Table 8.2. The new layout has been presented in Figures 8.4, 8.5 and 8.6.

Classroom Equipment Arrangement (Basic Equipment)	
Microphones	<ul style="list-style-type: none"> <li>- Increase the number of microphones in the classroom to 27 microphones (every 2 to 3 students will share one microphone in this case) (See 1 in Figures 8.4).</li> <li>- Use hypercardioid adjustable gooseneck microphones with automatic mixer (the mixer will allow to switch off all the microphones, except for the one in use).</li> <li>- Mount these microphones on students' desks for better access and better sound quality.</li> </ul>
Screens	<ul style="list-style-type: none"> <li>- Replace the current televisions with four flat-panel HD televisions and keep them in the same location (See 2,3,4,5 in Figures 8.4).</li> <li>- The size of televisions 1 and 2 should be no less than 21 inches, while the size of televisions 3 and 4 should be no less than 28 inches (See 2, 3, 4 and 5 in Figures 8.4 and 8.5).</li> <li>- Screens should be located at least 6 feet from the floor.</li> </ul>
Loudspeakers	<ul style="list-style-type: none"> <li>- Use four ceiling-mounted loudspeakers (See 6 in Figures 8.4).</li> <li>- Choose loudspeakers that have a uniform response frequency and wide covering angle (more than 140°) for better sound quality.</li> </ul>
Interactive Whiteboard	<ul style="list-style-type: none"> <li>- Add an interactive whiteboard to the classroom (See 7 in Figures 8.5)</li> <li>- Place it on the front wall of the room, no less than 6 feet from the floor.</li> </ul>
CODEC	<ul style="list-style-type: none"> <li>- Locate the CODEC at the rear of the classroom (See 8 in Figures 8.4).</li> </ul>
Other Equipment	<ul style="list-style-type: none"> <li>- Use SMART symposium, documented camera and a ceiling-mounted projector (all of which are already installed in most classrooms in KSU; See 9,10,11 in Figures 8.4 and 8.5).</li> </ul>
Physical Features	
Windows Covering	<ul style="list-style-type: none"> <li>- Use room darkening roller shades, such as Draper Dual Roller Flexshades, to allow the distance learning room to be completely darkened (See 12 in Figures 8.4).</li> <li>- The coverings can be manually operable if windows are accessible; if</li> </ul>

	not, coverings should be motorized with easily accessible controls.
Students Desk and Chairs	<ul style="list-style-type: none"> <li>- Use continuous fixed work surfaces that are at least 18 inches deep, with upholstered movable chairs instead of tablet-arms seats (See 13 in Figures 8.4).</li> <li>- Provide at least 2 workstations for students in wheelchairs (See 14 in Figures 8.4).</li> <li>- Add access for wheelchair students (See 15 in Figures 8.4).</li> </ul>
Other features	- There are many other recommendations for physical features of the classroom. all of which have been summarised in Table 8.4.

Table 8.2: Equipment Arrangement and Physical Features of the Classroom

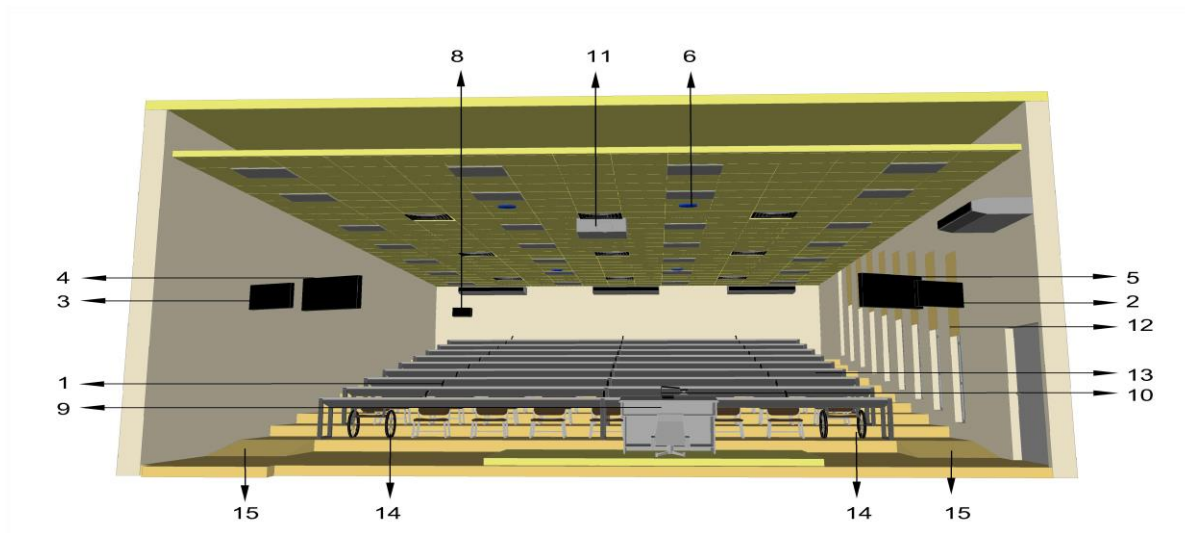


Figure 8.4: The Recommended Physical Design for KSU Classrooms

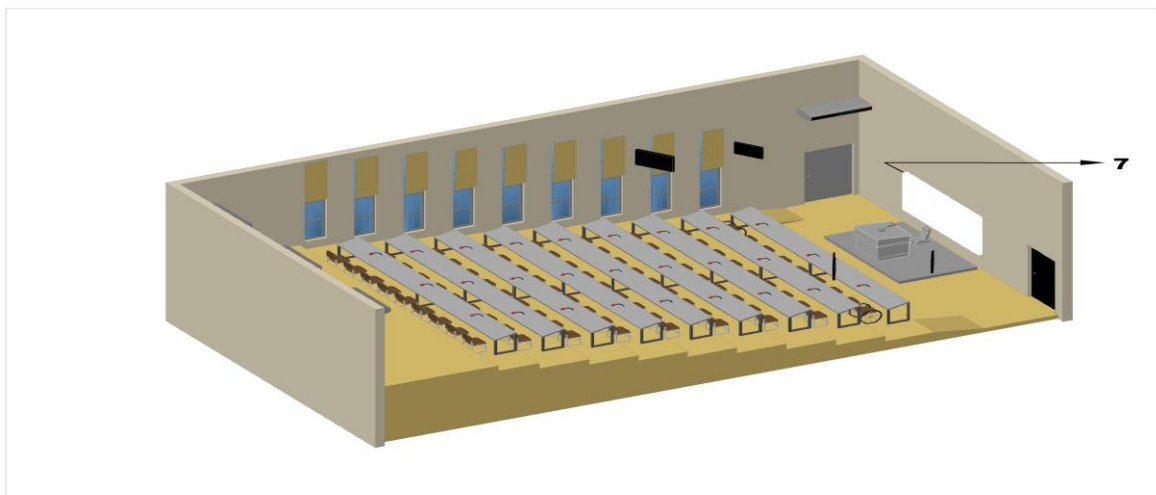


Figure 8.5: The Recommended Physical Design for KSU Classrooms

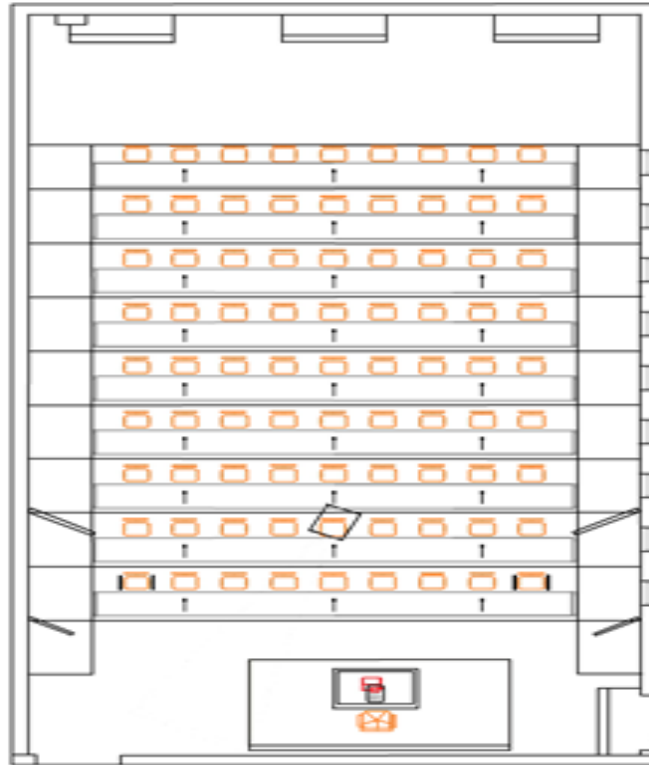


Figure 8.6: The Recommended Physical Design for KSU Classrooms

### 8.6 Summary

This chapter discussed the results of the study that was presented in chapter 7 and proposed feasible solutions for the most common problems in the distance-learning classrooms in KSU. A conclusion of the study, along with limitations and suggestions of the further research, will be given in the next chapter.

# 9 Conclusion and Further Work

This chapter summarises the work done in this thesis. It presents a thesis overview, the contribution of the research, as well as the criteria for its success. Finally, the limitations of the research as well as recommendations for further work will be given.

## 9.1 Thesis Overview

This research has discussed in detail the five crucial components of the distance-learning classrooms that use video conferencing technology in KSU. These are classroom physical design, classroom physical features, classroom technical support, classroom management and finally, communication and participation with male instructors in the classroom. The thesis reveals the perceptions of female students with regard to all these components, and the problems faced by these students in terms of each of these components have been identified in Chapter 7 and discussed in Chapter 8. The thesis proposes some feasible solutions for these problems as presented in Chapter 8. The thesis proposes an innovative interactive communication system for supporting communication and participation in the classroom, and, as presented in Chapter 8, it also proposes a new physical design (layout) that KSU is advised to apply.

## 9.2 Criteria for Success and Contributions of the Thesis

Six main research questions were posed in Chapter 1. The research can be judged in terms of success in providing answers to these. The answer to each of the research questions as well as the contribution of the research is summarised as follows:

**RQ1:** What are the problems that face female students in the distance-learning classrooms in Saudi Universities?

**Methodology:** SLR+ Pilot Study (See Chapter 3.2).

**Results:** Identified the major problems facing female students in distance-learning classrooms that use video-conferencing technology, and classified these problems into five main categories: classroom physical design, classroom physical features, technical support, classroom management and finally communication and participation with male instructors (See Chapter 2).

**Contribution of the Thesis:** It identifies five crucial components of the distance-learning classroom that uses video-conferencing technology, and discusses these components in detail.

**RQ2:** What are the strategies that should be followed for the effective design of distance-learning classrooms that use video-conferencing technology in KSU?

**Methodology:** Literature Review (See Chapter 3.3).

**Results:** The list of strategies that should be followed for the effective design of distance-learning classrooms that use video-conferencing technology have been identified (See Chapter 5).

**Contribution of the Thesis:** It offers a list of strategies for the effective design of the equipment arrangement in distance-learning classrooms that use video conferencing technology; It offers a list of strategies for the effective design of the physical features in distance-learning classrooms that use video conferencing technology; It offers a list of strategies for improving technical support for distance-learning classrooms that use video conferencing technology; It offers a list of strategies for effective classroom management and reducing discipline problems.

**RQ3:** What are the perceptions of female students in the College of Computer and Information Sciences in KSU towards the problems they encounter in distance-learning classrooms that use video-conferencing technology?

**Methodology:** Questionnaire (See Chapter 3.3.1).

**Results:** The perceptions of female students regarding the problems they encounter in distance-learning classrooms that use video conferencing technology at KSU have been identified (See Chapter 7.3.).

**RQ4:** What are the feasible solutions for the current problems reported by female students in distance-learning classrooms that use video-conferencing technology in KSU?

**Methodology:** Questionnaire + Observation + Literature Review (See Chapter 3.3).

**Results:** Feasible solutions for the problems facing female students have been provided (See Chapter 7).

**Contribution of the Thesis:** It recommends a new layout for the distance-learning classroom that use video-conferencing technology. This can be used in KSU as well as in institutions internationally.

**RQ5:** What is the better method to create an innovative interactive communication system (CommEasy) for participation enhancement in the classroom?

**Methodology:** Incremental Software Development Approach (See Chapter 3.4).

**Results:** Developing the CommEasy system for communication and participation enhancement in the classroom (see Chapter 6).

**RQ6:** What is the impact of using CommEasy on the participation level of female students with male instructors in distance-learning classrooms in KSU?

**Methodology:** Quasi- Experiment (See Chapter 3.5).

**Results:** The CommEasy system has increased the level of student participation in the distance-learning classroom (See Chapter 7.6).

**Contribution of the Thesis:** It produce an innovative interactive communication system (CommEasy) that proves to be very useful in enhancing communication and participation in the distance-learning classroom; It provides a list of recommendations for the effective using of new technologies in the classroom.

### 9.3 Limitations of the Research

The researcher recognises that this study may be limited by the situations that are described as follows:

- This study focuses on the perceptions of female students at KSU with regard to the distance-learning environment that uses video-conferencing technology which is described in Chapter 4.2. Other means of delivering distance-learning such as audio conferencing, desk-top video conferencing etc. are not examined in this study.
- The results of this study relate to KSU in Saudi Arabia. The researcher does not guarantee that all the results can be generalised to any other country.
- Neither the transmission medium such as fibre optics, microwave signals, etc., nor the components of the male instructor's studios were evaluated in this study. However, a brief discussion for these topics has been provided in the study.
- This research used a questionnaire to gather the information needed for this study. The use of a questionnaire limits this study due to the deficiency associated with the questionnaire method of research, such as the respondents' honesty and the differences in the way in which they might understand the questions.
- The version of the CommEasy system that is provided will support only an iOS platform. Other mobile platforms such as Android cannot be supported in this version due to time restrictions.

- The version of the CommEasy system that is provided can be used only on smart handheld devices and not desktop computers.
- The version of the CommEasy system that is provided can support iOS 5.0.1 to iOS 7.0.4 which was the latest version released by Apple prior to the submission of this research. No versions before iOS 5.0.1 can be supported.

#### **9.4 Future Work**

There is considerable scope for further work in this research area. Suggestions of future research in this field are as follows:

- It is recommended that further studies be conducted to identify the perceptions of male instructors in KSU towards teaching female students in distance-learning classrooms, in order to identify problems facing male instructors in this regard and in order to propose solutions accordingly.
- It is recommended that further studies investigate the physical features of classrooms at KSU and at other universities in Saudi Arabia. There is a lack of literature available in this regard, despite the importance of these components in the teaching-learning process.
- It is recommended that further studies be conducted to investigate the reasons for discipline problems in distance-learning classrooms at KSU and to propose additional solutions accordingly.
- It is recommended that further studies be undertaken to test the suggested strategies for reducing the discipline problems mentioned in this study.
- It is recommended that a further detailed experiment be conducted to evaluate how CommEasy could be used to accommodate different learning styles, such as active learning and cooperative learning etc.

#### **9.5 Summary**

This chapter summarised and concluded the work done in this thesis. It discussed the contribution of this thesis and the criteria for its success. Finally, the limitations of this research, as well as a few recommendations for future work have been given in this chapter.

# 10 Appendix and References

**APPENDIX 3-A**

**Perceptions of Females Students Toward Video and Audio Conferencing Technologies in Saudi Arabia**

The purpose of this questionnaire is to identify some perceptions that female students who enrolled in distance-learning classrooms with male instructors have towards the use of video and audio conferencing technologies in this context. It also aims to identify the most common problems faced students in distance-learning classrooms, as well as propose some feasible solutions to these problems. The questionnaire also aims to identify how female students would respond to a comprehensive study being conducted to investigate the problems encountered them in distance-learning classrooms with male instructors. The results of this questionnaire will become part of a comprehensive study to be conducted in this area.

If you are enrolled with a male instructor in a distance-learning classroom using video or audio conferencing technologies, please participate in this study by completing this questionnaire.

1- To what extent are you satisfied or dissatisfied with Video Conferences Technology?

- Very Satisfied.
- Satisfied.
- Neutral.
- Dissatisfied.
- Very Dissatisfied.

2- To what extent are you satisfied or dissatisfied with Audio Conference Technology?

- Very Satisfied.
- Satisfied.
- Neutral.
- Dissatisfied.
- Very Dissatisfied.

3- Which technology do you prefer?

- Video Conferencing.
- Audio Conferencing.
- Other (please specify.....).

4- Do you encounter any impediments to learning (problems) in these distance-learning classrooms?

- Yes.
- No.

5- How would you evaluate the effectiveness of these technologies in terms of: facilitating communication with the male instructor, the quality of images presented on the screens, the audio quality of loudspeakers, managing discipline problems? Please fill in your answers in the following tables:

Factors	Facilitating communication with the male instructor	The quality of images presented on the screens	The audio quality of loudspeakers	Managing discipline problems
Evaluation (Video Conferences Technology)	<input type="checkbox"/> Excellent	<input type="checkbox"/> Excellent	<input type="checkbox"/> Excellent	<input type="checkbox"/> Excellent
	<input type="checkbox"/> Good	<input type="checkbox"/> Good	<input type="checkbox"/> Good	<input type="checkbox"/> Good
	<input type="checkbox"/> Fair	<input type="checkbox"/> Fair	<input type="checkbox"/> Fair	<input type="checkbox"/> Fair
	<input type="checkbox"/> Poor	<input type="checkbox"/> Poor	<input type="checkbox"/> Poor	<input type="checkbox"/> Poor

Factors	Facilitating communication with the male instructor	The audio quality of loudspeakers	Managing discipline problems
Evaluation (Audio Conference )	<input type="checkbox"/> Excellent <input type="checkbox"/> Good <input type="checkbox"/> Fair <input type="checkbox"/> Poor	<input type="checkbox"/> Excellent <input type="checkbox"/> Good <input type="checkbox"/> Fair <input type="checkbox"/> Poor	<input type="checkbox"/> Excellent <input type="checkbox"/> Good <input type="checkbox"/> Fair <input type="checkbox"/> Poor

6- What barriers (problems) you face in these classrooms?

.....

7- Would you like to add any further comments?

.....

**Personal Information**

University .....

Major.....

Number of subjects you have studied with male instructors through Video and Audio conferencing.....

Degree:

- Undergraduates
- Postgraduates

Additional information you would like to mention.....

**Acceptance of Participation**

The objectives of this study are to improve distance-learning technologies used in Saudi Universities to teach female students by male instructors, and to solve any problems that students face in this regard.

By completing this questionnaire, you are freely agreeing to participate in this research. Your responses will be anonymous and used for research purposes only. However, the researcher may require you to contribute further in this research to achieve its objectives.

Do you agree to participate in this study?

- Yes (email.....).
- No (Thanks for contributing).

## APPENDIX 3-B

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

تصورات الطالبات تجاه تكنولوجيا مؤتمرات الفيديو والصوت في المملكة العربية السعودية

الغرض من هذا الاستبيان هو تحديد بعض التصورات لدى الطالبات المسجلات في فصول للتعليم عن بعد مع المعلمين الذكور تجاه استخدام تكنولوجيا الدوائر التلفزيونية المغلقة والمؤتمرات الصوتية في هذا السياق. تهدف الدراسة أيضا إلى تحديد المشاكل الأكثر شيوعا التي تواجهها الطالبات في الفصول الدراسية للتعلم عن بعد، وكذلك اقتراح بعض الحلول الممكنة لهذه المشاكل. يهدف الاستبيان أيضا إلى تحديد كيف ستكون استجابة الطالبات تجاه دراسة شاملة سوف تجرى للتحقيق في المشاكل التي تواجههن في الفصول الدراسية للتعلم عن بعد مع المعلمين الذكور. نتاج هذه الاستبيان ستكون جزء من دراسة شاملة شوف تتم في هذا المجال

إذا كنت ملتحة مع احد المعلمين الذكور في احد فصول التعليم عن بعد عن طريق تكنولوجيا الدوائر التلفزيونية المغلقة و المؤتمرات الصوتية. يرجى المشاركة في هذه الدراسة من خلال ملا هذا الاستبيان.

- إلى أي مدى أنتي راضية أو غير راضية عن تكنولوجيا مؤتمرات الفيديو ؟

- راضية جدا.  
 راضية.  
 محايدة.  
 غير راضية.  
 غير راضية جدا.

- إلى أي مدى أنتي راضية أو غير راضية عن تكنولوجيا مؤتمرات الفيديو ؟

- راضية جدا.  
 راضية.  
 محايدة.  
 غير راضية.  
 غير راضية جدا.

- ماهي التكنولوجيا التي تفضلينها ؟

- مؤتمرات الفيديو.  
 المؤتمرات الصوتية.  
 غيرها (الرجاء التحديد.....).

- هل تواجهين أي معوقات للتعلم (مشاكل) في هذه الفصول الدراسية للتعلم عن بعد؟

- نعم  
 لا

- كيف تقيمين فعالية هذه التكنولوجيا من حيث: تسهيل التواصل مع المعلمين الذكور, جودة الصور المعروضة على الشاشات, جودة الصوت من مكبرات الصوت وادارة مشاكل الانضباط. يرجى ملء اجابتك في الجداول التالية

العوامل	تسهيل التواصل مع المعلمين الذكور	جودة الصور المعروضة على الشاشات	جودة الصوت من مكبرات الصوت	ادارة مشاكل الانضباط
التقييم	<input type="checkbox"/> ممتازة	<input type="checkbox"/> ممتازة	<input type="checkbox"/> ممتازة	<input type="checkbox"/> ممتازة
(الدوائر التلفزيونية المغلقة)	<input type="checkbox"/> جيدة	<input type="checkbox"/> جيدة	<input type="checkbox"/> جيدة	<input type="checkbox"/> جيدة
	<input type="checkbox"/> عادلة	<input type="checkbox"/> عادلة	<input type="checkbox"/> عادلة	<input type="checkbox"/> عادلة
	<input type="checkbox"/> سيئة	<input type="checkbox"/> سيئة	<input type="checkbox"/> سيئة	<input type="checkbox"/> سيئة

العوامل	تسهيل التواصل مع المعلمين الذكور	جودة الصوت من مكبرات الصوت	ادارة مشاكل الانضباط
التقييم (المؤتمرات الصوتية)	<input type="checkbox"/> ممتازة <input type="checkbox"/> جيدة <input type="checkbox"/> عادلة <input type="checkbox"/> سيئة	<input type="checkbox"/> ممتازة <input type="checkbox"/> جيدة <input type="checkbox"/> عادلة <input type="checkbox"/> سيئة	<input type="checkbox"/> ممتازة <input type="checkbox"/> جيدة <input type="checkbox"/> عادلة <input type="checkbox"/> سيئة

- ما هي المشاكل التي تواجهها في هذه الفصول ؟

.....  
.....  
.....

- هل ترغبين في اضافة أي تعليقات؟

.....  
.....

معلومات شخصية

.....الجامعة  
.....التخصص  
عدد المواد التي سبق و درستها مع المعلمين الذكور من خلال مؤتمرات الفيديو والمؤتمرات الصوتية.....  
الدرجة الاكاديمية  
 بكالوريوس  
 دراسات عليا  
معلومات اضافية تودين اضافتها.....

#### قبول المشاركة

أهداف هذه الدراسة هي تطوير تكنولوجيا التعلم عن بعد المستخدمة في الجامعات السعودية لتدريس الطالبات من قبل المعلمين الذكور، و حل أي مشاكل تواجهها الطالبات في هذا الصدد.

من خلال استكمال هذا الاستبيان، فإنك توافقين بحرية على الاشتراك في هذا البحث. استجابتك سوف تظل مجهولة المصدر وتستخدم لأغراض البحث فقط. على كل حال، قد تتطلب منك الباحثة مواصلة الإسهام في البحث من أجل تحقيق أهدافه.

هل توافقين على المشاركة في هذه الدراسة ؟

نعم (البريد الإلكتروني.....)

لا (شكرا للمساهمة )

## **APPENDIX 3-C**

### **Perceptions of Female Students Toward Video Conferencing Technology at KSU**

The aim of this questionnaire is to identify the perceptions of female students, who are enrolled with male instructors in distance-learning classrooms in KSU regarding problems they encounter in this learning environment. It also aims to propose some feasible solutions to the most common problems. The findings of this study should provide decision makers in KSU with an insight into these problems and the possible ways they could be solved.

This questionnaire is ten pages long. Please check that you have filled in all pages appropriately before returning the questionnaire to the researcher.

#### i- Classroom equipment arrangement

Instructions: each question below asks you about your satisfaction level with the current equipment arrangement in the classroom. Please only evaluate the classroom in which you are currently located. Please read each question carefully and respond by ticking the box that best represents your level of satisfaction. As the questionnaire asks about your own opinions, there are no right or wrong answers.

Questions	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
How satisfied or dissatisfied are you with access to microphones in the classroom?					
How satisfied or dissatisfied are you with the number of microphones in the classroom?					
How satisfied or dissatisfied are you with the loudspeakers arrangement in the classroom?					
How satisfied or dissatisfied are you with the arrangement of the instructor's camera?					
How satisfied or dissatisfied are you with the number of screens in the classroom?					
How satisfied or dissatisfied are you with the size of the screens?					
How satisfied or dissatisfied are you with the quality of the pictures displayed by the screens (i.e. screen resolution)?					
How satisfied or dissatisfied are you with the location of the screens in the classroom?					
What is your overall satisfaction level with the current arrangement of the classroom equipment?					

ii- The physical features of the classroom

Questions	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
How satisfied or dissatisfied are you with the size of the learning room?					
How satisfied or dissatisfied are you with the width of the aisles in the learning room?					
How satisfied or dissatisfied are you with the number of aisles in the learning room?					
How satisfied or dissatisfied are you with the handicap access in the classroom?					
How satisfied or dissatisfied are you with the noise level within the learning room?					
How satisfied or dissatisfied are you with the lighting in the learning room?					
How satisfied or dissatisfied are you with the acoustics of the learning room?					
How satisfied or dissatisfied are you with the student desks in the learning room?					
How satisfied or dissatisfied are you with the student chairs in the learning room?					
How satisfied or dissatisfied are you with the number of windows in the learning room?					
How satisfied or dissatisfied are you with the location of the windows in the learning room?					
How satisfied or dissatisfied are you with the size of the windows in the learning room?					
How satisfied or dissatisfied are you with the blinds/curtains in the learning room?					
How satisfied or dissatisfied are you with the door in the learning room?					
How satisfied or dissatisfied are you with the colour of the walls in the learning room?					
How satisfied or dissatisfied are you with the floor in the learning room?					
How satisfied or dissatisfied are you with the ceiling of the learning room?					

How satisfied or dissatisfied are you with the temperature in the learning room?					
How satisfied or dissatisfied are you with the ventilation in the learning room?					
How satisfied or dissatisfied are you with the air-conditioning in the learning room?					
How satisfied or dissatisfied are you with the cleanliness of the learning room?					
What is your overall satisfaction level with the current physical features in the learning room?					

iii- Technical Support in the classroom

Questions	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
How satisfied or dissatisfied are you with the performance of technical assistants in terms of their ability to solve technical problems?					
How satisfied or dissatisfied are you with the amount of time that is taken to solve these technical problems?					
How satisfied or dissatisfied are you with the working order of the equipment in the distance-learning classroom?					
What is your overall satisfaction level with the current technical support provided in the distance-learning classroom?					

iv- Classroom management and communication with male instructors.

Below is a set of items that represents some common problems regarding classroom management, communication and participation with male instructors in distance-learning classrooms. Please respond to ALL of the following items by choosing the response that best matches your opinion.

Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I am hesitating in participation with instructors because he is a man.					
I am not given a chance to participate with the instructor because the classroom is crowded.					
I am participating more when I sit near the microphones.					
I do not attend distance learning classes because I find that I am unable to engage in the learning environment.					
The authority of the male instructors is insufficient.					
The behaviour of some students in the classroom (e.g. making noise, inappropriate movements and disturbing peers) greatly affects my ability to concentrate on the instructor.					
I can't communicate with the instructor after a lecture.					

**Personal Information**

Name.....  
Age.....  
Number of subjects you have studied with male instructors through distance-learning technologies.....  
GPA.....  
Major.....  
Subject you are enrolled in during filling this questionnaire.....

## **APPENDIX 3-D**

Dear participant,

Your contribution to this study is really important, and I greatly appreciate the time you have taken to complete this questionnaire. .

**Objectives:** The objective of this questionnaire is to identify perceptions of female students who are enrolled with male instructors in distance-learning classrooms in KSU regarding problems they encounter in this learning environment. The study also aims to propose feasible solutions for the most common problems. The results of the study should provide insight for decision-makers in Saudi Arabia regarding the current problems and the feasible solutions.

**Risks:** There are no known risks for you.

**Participation:** Your participation in this study is voluntary. If you complete the survey, you are essentially providing your consent to participate in the research.

**Confidentiality:** Your confidentiality will be protected. Any information obtained from your responses will not be associated with your identity; your answers will remain anonymous and confidential.

At the end of the questionnaire, there are instructions on how to request a summary of the study's findings.

Thank you for your consideration and cooperation.

The researcher,

Abeer Algarni

School of Engineering and Computing Sciences, Durham University, DH1 3LE

عزيزتي المشاركة

مساهمتم في هذه الدراسة هي جدا مهمة و أنا أقدر كثيرا مساهمتك في استكمال هذا الاستبيان.

**الأهداف:** إن الهدف من هذا الاستبيان هو تحديد تصورات الطالبات اللاتي التحقن مع المعلمين الذكور في الفصول الدراسية للتعلم عن بعد في جامعة الملك سعود تجاه المشاكل التي تواجههن في هذه البيئة التعليمية. تهدف الدراسة أيضا إلى اقتراح الحلول الممكنة للمشاكل الأكثر شيوعا. نتائج هذه الدراسة سوف تقدم رؤية لصناع القرار في المملكة العربية السعودية بشأن المشاكل الحالية والحلول الممكنة .

**المخاطر:** لا توجد مخاطر معروفة تترتب على تعبئة هذه الاستبانة.

**المشاركة:** مشاركتك في هذه الدراسة هو تطوعي. بتعبئة هذا الاستبيان فانك توافقين بحرية للمشاركة في هذا البحث

**السرية :** هويتك سوف تظل محمية. أي معلومات يتم الحصول عليها من استجاباتك لن يتم ربطها بهويتك الحقيقية. ستبقى إجاباتك مجهولة وسرية.

في نهاية الاستبيان ، هناك تعليمات حول كيفية طلب ملخص لنتائج هذه الدراسة .

أشركم على اهتمامكم والتعاون.

الباحثة

عبير القرني , كلية الهندسة وعلوم الحاسب الآلي, جامعة درهام  
بريطانيا

## **APPENDIX 3-E**

### **Acceptance of Participation**

The results of this study will contribute to the improvement of distance-learning technologies at KSU and will provide valuable suggestions for decision-makers in the university.

To achieve the objectives of the study, the researcher need you to contribute again. Responses will be anonymous and used for research purposes only.

Do you agree to participate further in this study?

- Yes (E-mail(.....:)).  
 No (Thank you for your contribution).

Finally, if you would like to be informed of the results of this study, please provide an e-mail address below to receive a copy of the results as soon as they are available.

- I would like to receive the results of this study. (E-mail.....  
 I would not like to receive the results of this study.

### **قبول المشاركة**

نتائج هذه الدراسة سوف تساهم في تحسين تقنيات التعلم عن بعد في جامعة الملك سعود، وسوف تقدم اقتراحات قيمة لصناع القرار في الجامعة.

لتحقيق أهداف الدراسة، فإن الباحثة بحاجة لمساهمتك مرة أخرى. الاستجابات ستظل مجهولة المصدر وتستخدم لأغراض البحث فقط.

هل توافقين على مواصلة المشاركة في هذه الدراسة؟

- نعم (البريد الإلكتروني: .....).  
 لا (شكرا لمساهمتمكم).

أخيرا، إذا كنت ترغبين في الاطلاع على نتائج هذه الدراسة، يرجى تقديم عنوان البريد الإلكتروني أدناه للحصول على نسخة من النتائج حال توفرها.

- وأود أن أتلقى نتائج هذه الدراسة (البريد الإلكتروني .....).  
 أنا لا أرب في الحصول على نتائج هذه الدراسة.

### **APPENDIX 3-F**

There are many experts who helped to revise, evaluate and update many parts of this thesis. All of them are mentioned below and the researcher owes a debt of gratitude to all of them for their valuable comments:

#### Dr. Andrew Hatch

Dr. Hatch was previously a research associate and a member of the Technology Enhanced Learning Research Group at the Department of Computer Science, Durham University, United Kingdom.

#### Dr. Phyo Kyaw

Dr. Kyaw was previously a research associate and a member of the Technology Enhanced Learning Research Group at the Department of Computer Science, Durham University, United Kingdom.

#### Dr Iyad Alagha

Dr. Alagha was previously a research associate and a member of the Technology Enhanced Learning Research Group at the Department of Computer Science, Durham University, United Kingdom.

#### Dr. Maria Anjum

Dr. Anjum was previously a Research Postgraduate in the Innovative Computing Research Group, School of Engineering and Computing Sciences, Durham University, United Kingdom.

#### Dr. Khalid Yousif-Mohammad

Dr. Yousif-Mohammad was previously a Research Postgraduate in the Innovative Computing Research Group, School of Engineering and Computing Sciences, Durham University, United Kingdom.

#### Dr.Nora AlKhaldi

Dr. Alkhaldi is a Research Postgraduate, PhD, in the Department of Computer Science, The University of Sheffield, United Kingdom.

#### Dr. Sadia Saleem

Dr. Saleem is a Research Postgraduate, PhD, in the Department of Computer Science, The University of Manchester, United Kingdom.

There are many Master and PhD students who helped to translate and revise all the Arabic versions of the instruments used in this research. Most were either a Master or PhD in the School of Modern Languages and Cultures at Durham during the course of this thesis. They were ( Mr. Khaled; Mr. Mohammad; Mrs. Rania; Mrs. Aishah; Mrs. Fawziah; Mr. Ahmad; Mrs. Aishaa; Mrs. Fatimah; Mrs. Summaiah and Miss. Amal ).

### APPENDIX 3-G

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

تصورات الطالبات تجاه تكنولوجيا مؤتمرات الفيديو في جامعة الملك سعود

الهدف من هذا الاستبيان هو التعرف على تصورات الطالبات اللاتي التحقن مع المعلمين الذكور في الفصول الدراسية للتعلم عن بعد في جامعة الملك سعود بشأن المشاكل التي تواجههن في هذه البيئة التعليمية. كما يهدف إلى اقتراح بعض الحلول العملية للمشاكل الأكثر شيوعا. نتاج هذا الاستبيان ينبغي أن تزود صانعي القرار في جامعة الملك سعود بنظرة ثاقبة لهذه المشاكل و السبل الممكنة لحلها.

هذا الاستبيان يتضمن عشر صفحات. يرجى التأكد من أنك ملأت كل الصفحات بشكل مناسب قبل أن تعيدي الاستبيان الى الباحثة.

- ترتيب معدات الفصول الدراسية

تعليمات : كل سؤال أدناه يسألك عن مستوى رضاك عن الترتيب الحالي للمعدات في الفصول الدراسية. يرجى تقييم الفصل الدراسي المتواجدة فيه حاليا فقط. يرجى قراءة كل سؤال بعناية و الرد بوضع علامة في أفضل مربع يمثل مستوى رضاك. بما أن الاستبيان يسألك عن رأيك الشخصي، لا توجد إجابات صحيحة أو خاطئة.

السؤال	راضية بشدة	راضية	محايد	غير راضية	غير راضية بشدة
ما مدى رضاك أو عدم رضاك عن الوصول إلى الميكروفونات في الفصول الدراسية؟					
ما مدى رضاك أو عدم رضاك عن عدد من الميكروفونات في الفصول الدراسية؟					
ما مدى رضاك أو عدم رضاك عن ترتيب مكبرات الصوت في الفصول الدراسية؟					
ما مدى رضاك أو عدم رضاك عن تنظيم الكاميرات الموجودة في الاستديو الذي يتواجد فيه عضو هيئة التدريس؟					
ما مدى رضاك أو عدم رضاك عن عدد من الشاشات في الفصول الدراسية؟					
ما مدى رضاك أو عدم رضاك عن حجم من الشاشات؟					
ما مدى رضاك أو عدم رضاك عن جودة الصور المعروضة في الشاشات (أي دقة الشاشة)؟					
ما مدى رضاك أو عدم رضاك مع موقع الشاشات في الفصول الدراسية؟					
ما هو مستوى رضاك العام عن الترتيب الحالي للمعدات في الفصول الدراسية؟					

- الخصائص الفيزيائية للفصول الدراسية

السؤال	راضية بشدة	راضية	محايد	غير راضية	غير راضية بشدة
ما مدى رضاك أو عدم رضاك عن حجم غرفة التعلم؟					
ما مدى رضاك أو عدم رضاك عن عرض الممرات في غرفة التعلم؟					
ما مدى رضاك أو عدم رضاك عن عدد الممرات في غرفة التعلم؟					
ما مدى رضاك أو عدم رضاك عن التسهيلات المقدمة للطلبة ذوي الإعاقة في غرفة التعلم؟					
ما مدى رضاك أو عدم رضاك عن مستوى الضوضاء في غرفة التعلم؟					
ما مدى رضاك أو عدم رضاك عن الإضاءة في غرفة التعلم؟					
ما مدى رضاك أو عدم رضاك عن الصوتيات في غرفة التعلم؟					
ما مدى رضاك أو عدم رضاك عن مكاتب الطالبات في غرفة التعلم؟					
ما مدى رضاك أو عدم رضاك عن كراسي الطالبات في غرفة					

					التعلم ؟
					ما مدى رضاك أو عدم رضاك عن عدد النوافذ في غرفة التعلم ؟
					ما مدى رضاك أو عدم رضاك عن حجم النوافذ في غرفة التعلم ؟
					ما مدى رضاك أو عدم رضاك عن مواقع النوافذ في غرفة التعلم ؟
					ما مدى رضاك أو عدم رضاك عن الستائر في غرفة التعلم ؟
					ما مدى رضاك أو عدم رضاك عن موقع الباب في غرفة التعلم ؟
					ما مدى رضاك أو عدم رضاك عن لون الجدران في غرفة التعلم ؟
					ما مدى رضاك أو عدم رضاك عن الأرضية في غرفة التعلم ؟
					ما مدى رضاك أو عدم رضاك عن السقف في غرفة التعلم ؟
					ما مدى رضاك أو عدم رضاك عن درجة الحرارة في غرفة التعلم ؟
					ما مدى رضاك أو عدم رضاك عن التهوية في غرفة التعلم ؟
					ما مدى رضاك أو عدم رضاك عن التكييف في غرفة التعلم ؟
					ما مدى رضاك أو عدم رضاك عن نظافة غرفة التعلم ؟
					ما هو مستوى رضاك العام عن الخصائص الفيزيائية الحالية في غرفة التعلم ؟

- الدعم الفني

					السؤال
					ما مدى رضاك أو عدم رضاك عن أداء المساعدين التقنيين من حيث قدرتهم على حل المشاكل التقنية ؟
					ما مدى رضاك أو عدم رضاك عن كمية الوقت الذي يستغرق لحل هذه المشاكل التقنية ؟
					ما مدى رضاك أو عدم رضاك عن الحالة التشغيلية للمعدات في الفصل الدراسية للتعلم عن بعد.
					ما مدى رضاك العام عن الدعم التقني الحالي المقدم للفصول الدراسية للتعلم عن بعد

- إدارة الصف والتواصل مع المدرسين الذكور

فيما يلي مجموعة من العناصر التي تمثل بعض المشاكل الشائعة المتعلقة بإدارة الفصول الدراسية و الاتصال والمشاركة مع المعلمين الذكور في الفصول الدراسية للتعلم عن بعد. يرجى الرد على كل من العناصر التالية عن طريق اختيار أفضل استجابة تمثل رأيك.

					العبارة
					أنا مترددة في المشاركة مع المعلم لأنه رجل.
					لا أجد فرصة للمشاركة مع المعلم بسبب ازدحام الفصول الدراسي.
					أشارك أكثر عندما أجلس بالقرب من الميكروفونات.
					أنا لا أحضر محاضرات التعلم عن بعد لأنني أجد أنني غير قادرة على الاندماج في هذه البيئة التعليمية.
					سلطة المعلمين الذكور غير كافية.
					سلوك بعض الطلاب في الفصول الدراسية (على سبيل المثال خلق الضوضاء، الحركات الغير مناسبة و ازعاج الأقران) تؤثر بشكل كبير في قدرتي على التركيز على المعلم.
					لا أستطيع التواصل مع المعلم بعد محاضرة.

معلومات شخصية

.....الاسم  
.....العمر  
.....عدد المواد التي سبق و درستيها مع المعلمين الذكور من تكنولوجيا التعليم عن بعد  
.....المعدل  
.....التراكمي  
.....التخصص  
.....المادة المسجلة فيها أثناء ملأ هذه الاستبيان

**APPENDIX 3-II**

**Questionnaire Evaluation Form**

I would be grateful if you could respond to the following questions. Please feel free to provide any additional comments as you see fit.

i- Questionnaire introduction:

- 1- Is the information on the cover page clear and understandable?
- 2- Do you think the introduction at the beginning of the questionnaire is appropriate and understandable?

ii- Sections related to classroom equipment arrangements, the physical features of the classroom, and technical support in the classroom: Are the instructions at the beginning clear and understandable?

- 1- Are the instructions at the beginning clear and understandable?
- 2- Are the questions clear and understandable?
- 3- In your opinion, was the use of 5-point Likert scale (Very Satisfied, Satisfied, Neutral, Dissatisfied, Very Dissatisfied) appropriate and understandable in this survey?
- 4- Did you find it easy to apply this scale?
- 5- Would you modify or change any of the questions?

iii- Section related to classroom management and the participation of male instructors.

- 1- Are the instructions at the beginning clear and understandable?
- 2- Are the statements clear and understandable?
- 3- In your opinion, was the 5-point Likert scale understandable?
- 4- Did you find it easy to apply this scale?
- 5- Would you modify or change any of the statements?
- 6- Are the open-ended questions clear and understandable?

iv- Overall questionnaire design

- 1- Please comment on the overall ease of reading.
- 2- Are there any specific changes you would add to this questionnaire?

Finally, Could you please provide some information about yourself?

.....  
.....  
.....

Thank you so much for your contribution to this questionnaire.. Your comments will use to improve this questionnaire.

The researcher,

Abeer Algarni

## استمارة تقييم الاستبيان

سأكون ممتنا جدا لو تفضلتم بالرد على الأسئلة التالية . أرجو ألا تتردد في تقديم أي تعليقات تراها مناسبة. يرجى ملء إجابتك في الورقة المرفقة مع النموذج.

### - مقدمة المسح

- 1 . هي المعلومات على صفحة الغلاف واضحة ومفهومة ؟
- 2 . هل تعتقد أن المقدمة في بداية الاستبيان مناسبة ومفهومة

- الأقسام المتعلقة ترتيب المعدات الفصول الدراسية، و الخصائص الفيزيائية للفصل الدراسي و الدعم الفني في الفصول الدراسية :

- 1 . هل التعليمات في البداية واضحة ومفهومة ؟
- 2 . هل الأسئلة واضحة ومفهومة ؟
- 3 . في رأيك، هل استخدام مقياس ليكرت المكون من خمس نقاط ( راضية جدا، راضية، محايدة، غير راضية، غير راضية جدا) مناسب ومفهوم ؟
- 4 . هل تجد أنه من السهل تطبيق هذا المقياس ؟
- 5 . هل ترغب في تعديل أو تغيير أي من الأسئلة ؟

- القسم المتعلقة بإدارة الفصول الدراسية والتواصل مع المعلمين الذكور:

- 1 . هل التعليمات في البداية واضحة ومفهومة ؟
- 2 . هل العبارات واضحة ومفهومة ؟
- 3 . في رأيك، هل استخدام مقياس ليكرت المكون من خمس نقاط ( أوافق بشدة , أوافق , محايدة , لا أوافق , لا أوافق بشدة) مناسب ومفهوم ؟
- 4 . هل تجد أنه من السهل تطبيق هذا المقياس ؟
- 5 . هل ترغب في تعديل أو تغيير أي من الأسئلة ؟
- 6 . هي الأسئلة المفتوحة واضحة ومفهومة ؟

- التصميم الكلي للاستبيان

- 1 . يرجى التعليق على سهولة قراءة الاستبيان بشكل عام .
- 2 . هل هناك أي تغييرات معينة يمكن ان تضفيها للاستبيان؟

أخيرا ، أرجو أن تقدم بعض المعلومات عن نفسك ؟

.....  
.....  
.....

شكرا جزيلاً لمساهماتك في هذا الاستطلاع. سوف تساعد تعليقاتكم على تطوير هذا الاستبيان .

الباحث ،  
عبير القرني.

### **APPENDIX 3-I**

Dear Expert,

I am a doctoral student in the School of Engineering and Computing Sciences at Durham University. The aim of my research is to identify the perceptions of female students in Saudi Arabia who are enrolled with male instructors in distance-learning classrooms within King Saud University (KSU) that use video conferencing technology with regard to the problems they encounter in such a learning environment. Understanding the perceptions of those who use this technology is very important when it comes to determining the current problems that exist in terms of the use of these classrooms. The study also aims to propose feasible solutions for the most common problems. The results of this study will help to improve the distance-learning technologies used in Saudi universities and provide decision makers with an insight into the current problems and the necessary improvements.

The researcher will use a questionnaire aimed at female students in KSU. This questionnaire will identify their perceptions with regard to five main components of the distance-learning classroom (classroom equipment arrangement, the physical features of the classroom, technical support in the classroom, classroom management and communication, and interaction with male instructors).

The researcher would very much appreciate if you would be kind enough to help in this research by reading the questionnaire and making comments, suggestions etc. using the attached form.

Your comments will be used to improve the questionnaire and approve the last version that will be used for data collection.

If you have any questions regarding the project, please feel free to contact me using the following email address: [abeer.algarni@dur.ac.uk](mailto:abeer.algarni@dur.ac.uk).

Thank you for your time and assistance.

Sincerely

Abeer Algarni

### Questionnaire Evaluation Form

I would be grateful if you could respond to the following questions. Please feel free to provide any additional comments as you see fit.

i- Questionnaire introduction:

- Is the information on the cover page clear and understandable?
- Do you think the introduction at the beginning of the questionnaire is appropriate and understandable?

ii- Sections related to classroom equipment arrangements, the physical features of the classroom, and technical support in the classroom: Are the instructions at the beginning clear and understandable?

- Are the questions clear and understandable?
- In your opinion, was the use of 5-point Likert scale (Very Satisfied, Satisfied, Neutral, Dissatisfied, Very Dissatisfied) appropriate and understandable in this survey?
- Did you find it easy to apply this scale?
- Would you modify or change any of the questions?

iii- Section related to classroom management and the participation of male instructors.

- Are the instructions at the beginning clear and understandable?
- Are the statements clear and understandable?
- In your opinion, was the 5-point Likert scale understandable?
- Did you find it easy to apply this scale?
- Would you modify or change any of the statements?
- Are the open-ended questions clear and understandable?

iv- Overall questionnaire design

- Please comment on the overall ease of reading.
- Are there any specific changes you would add to this questionnaire?

Finally, Could you please provide some information about yourself?

.....  
.....  
.....

Thank you so much for your contribution to this questionnaire.. Your comments will use to improve this questionnaire.

The researcher,

Abeer Algarni

## **APPENDIX 3-J**

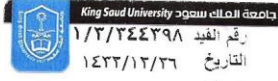
### **The official procedures for conducting the study**

The following documents were sent to the Cultural Bureau of Saudi Arabia in London, as it is the government body responsible for Saudi students in the UK:

- 1- A letter from the supervisor to confirm the importance of conducting this study.
- 2- The questionnaire in Arabic and in English.
- 3- The complete research plan.
- 4- The research proposal.
- 5- The result of the first year assessment report completed by the supervisor.
- 6- A detailed explanation of data collection procedures.
- 7- A covering letter from the researcher to Prof. Al-Makki, the Saudi Cultural Attaché to the United Kingdom and Ireland.

The Bureau sent the documents to a Commission of Scientific Research in the Cultural Bureau for evaluation and their approval was obtained. The Cultural Bureau in London then contacted the Deanship of Graduate Studies and Scientific Research in KSU to give their permission for a researcher to conduct the study there, and permission was successfully granted.

### APPENDIX 3-K



بسم الله الرحمن الرحيم



احترم

سعادة وكيل الجامعة للدراسات العليا والبحث العلمي

السلام عليكم ورحمة الله وبركاته

أفيد سعادتكم بأنني عبير بنت ظافر القرني طالبة دكتوراه في كلية الهندسة وعلوم الحاسب الآلي بجامعة دورهام بالمملكة المتحدة ونظرا لكوني محني يتعلق بتطوير تكنولوجيا الشبكات والاتصالات المستخدمة في التواصل بين أعضاء هيئة التدريس الذكور وبين الطالبات في جامعات المملكة العربية السعودية فإني احتاج في هذه المرحلة إلى إجراء دراسة علمية على عينة من فصول الشبكات التعليمية في الجامعة للتعرف على فاعلية التكنولوجيا الحالية المستخدمة ودورها في حل المشاكل التي تواجه الطالبات في هذه البيئة التعليمية وهذه الدراسة سوف تشمل أدوات قياس منها توزيع استبيانات على الطالبات وتتضمن الملاحظة المقتنة لفصول الشبكات في الفصل الدراسي الأول من هذا العام 1432-1433 من تاريخ 1-12-2011 لمدة ثلاث اشهر بعد التنسيق مع المشرفات الموجودات علما أن ذلك سيكون له الأثر الكبير في إتمام البحث وسيعود بالنفع الكبير بإذن الله تعالى للكثير من الباحثين والتربويين في الجامعات السعودية عن واقع التكنولوجيا المستخدمة حاليا وعن سبل تطويرها كون هذه الطريقة استخدمت في المملكة العربية السعودية منذ عام 1970 وكانت المملكة هي أول دولة عربية تستخدم وتسخر هذه التقنية في تدريس الطالبات وذلك للحفاظ على هوية الفتاة السعودية وتسخير التقنية في خدمة العملية التعليمية بما يتناسب مع قيمنا ورغم استخدام هذه التقنية منذ هذه الفترة الطويلة ودورها الفعال في تعليم الطالبات في كل جامعات المملكة فإن الأبحاث المتعلقة بمشاكل الطالبات والأعضاء في هذه البيئة التعليمية وكيفية تطوير هذه التكنولوجيا قليلة جدا إن لم تكن معدومة وهذا ما دفعني للبحث في هذا المجال المهم.

التمس من الله ثم من سعادتكم التكرم بالسماح لي بإجراء الدراسة وتوجيه خطاب إلى من يهمه الأمر بموافقتكم الكريمة واعذكم بأن ابذل قصارى جهدي لأكون عند حسن ظنكم وظن الجميع. والله يحفظكم ويرعاكم.....

عبير ظافر القرني

١٥٥٥١٨٢٤٤٣

ظافر القرني

تمت مراجعته!  
د. صالح الربيع  
١٤٢٣/١٣/٢٦

## APPENDIX 3-L

Kingdom of Saudi Arabia  
Ministry of Higher Education  
**King Saud University**  
Code 034  
Vice-Rector's Office  
For Graduate Studies & Scientific  
Research



المملكة العربية السعودية  
وزارة التعليم العالي  
جامعة الملك سعود  
رمزها ٠٣٤  
مكتب وكيل الجامعة  
للدراسات العليا والبحث العلمي

Date:..... التاريخ:

No. .... الرقم:

سعادة الاستاذ الدكتور / الملحق الثقافي - بريطانيا ( ايرلندا )  
حفظه الله  
السلام عليكم ورحمة الله وبركاته ،،،

تشهد جامعة الملك سعود بان الطالبه / عبير ظافر عبد الرحمن القرني المبتعثه من جامعة  
( درم ) ببريطانيا في تخصص الحاسب الالي .. قد اتمت جمع البيانات الخاصة بدراساتها من الجامعة  
في الفترة ٢٠ ديسمبر ٢٠١١ م وحتى ٢٥ مارس ٢٠١٢ م . وبناء عليه منحت هذا الخطاب .

مع خالص الشكر والتقدير ،،،

مساعد وكيل الجامعة للدراسات العليا والبحث العلمي

للبرامج التطويرية

ابتسام

د. ابتسام بنت محمد العليان



هـ/الفضلي



P. O. Box 2454, Riyadh 11451 Tel: 4670108 Fax. : 4677999

ص. ب. الرياض ١١٤٥١ هاتف: ٤٦٧٠١٠٨ فاكس: ٤٦٧٧٩٩٩

www.ksu.edu.sa

Kingdom of Saudi Arabia  
Ministry of Higher Education  
**King Saud University**  
Code 034  
Vice-Rector's Office  
For Graduate Studies & Scientific  
Research

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



المملكة العربية السعودية  
وزارة التعليم العالي  
جامعة الملك سعود  
رمزها ٠٣٤  
مكتب وكيل الجامعة  
للدراسات العليا والبحث العلمي

Date:..... التاريخ:

No. .... الرقم:

To whom it may concern

This is to confirm that Mrs. Abeer Dhafer Algarni from School of Engineering and Computer Sciences at Durham University in UK has conducted a study at King Saud University in Riyadh from 20-12-2011 to 25-03-2011.

Assistant of Vice Rector for Graduate Studies  
and Scientific Research for Developmental Programs

ابتسام  
Dr. Ebtessam Al-Olayan



P. O. Box 2454, Riyadh 11451 Tel: 4670108 Fax. : 4677999

ص. ب. ٢٤٥٤ الرياض ١١٤٥١ هاتف: ٤٦٧٠١٠٨ فاكس: ٤٦٧٧٩٩٩

[www.ksu.edu.sa](http://www.ksu.edu.sa)

### **APPENDIX 3-M**

#### **The importance of students' preparation in reducing discipline problems in distance-learning classrooms in KSU**

The purpose of this questionnaire is to identify the current efforts of the KSU and the male instructors in providing appropriate preparation for female students before they joined distance-learning classrooms and the role of such preparation in reducing discipline problems in the distance-learning classrooms in KSU.

The preparation in this context relates to two aspects: first, create awareness among females students about distance-learning technologies, e.g., the advantages and limitations of these technologies, the differences between these technologies and the traditional classroom, and dealing and communicating with males instructors. Secondly, create awareness among female students about the rules and regulations of the university regarding managing the students' behaviour and what the consequences of breaking such rules. The results of this questionnaire will provide insight into the importance of the mentioned preparation and the current effort of the university and instructors in this regard. This questionnaire also aims to identify some of the causes of misbehaviour in these classrooms.

This questionnaire is four pages long. The researcher would really appreciate it if you could check that all the pages have been filled in appropriately before returning the questionnaire.

1- Did you attend any form of distance-learning before joining the university?

- Yes.
- No.

2- After joining the university, were there any efforts made to create awareness among the female students about the rules and regulations of the university regarding managing the students' behaviour or what the consequences of breaking such rules?

- Yes by the university (go to question 3,4,5).
- Yes by the instructor (go to questions 6,7).
- No (go to question 8).

3- What were the forms of these efforts?

- booklets.
- seminars (Less than 20 people).
- lectures (More than 20 people).
- noticeboards.
- others .....

4- From your point of view, were these efforts enough to educate students about the university rules and regulations?

- Yes.
- No.

5- Did such preparation prevent you from misbehaving or disrupting the class?

- Yes.
- No.

6- Did such preparation provided by your instructors prevent you from misbehaving or disrupting the class?

- Yes.
- No.

7- Did the instructor apply any useful methods for managing the discipline problems in the classroom?

- Yes, (please provide example of such a methods)  
.....
- No.

8- Were there any efforts made to create awareness among the female students about the distance-learning technologies, e.g. the advantages and limitations of these technologies, the differences between these technologies and the traditional classroom, and dealing and communicating with male instructors?

- Yes by the university (what were the form of these efforts.....  
.....).
- Yes by the instructor (what were the form of these efforts.....  
.....).
- No.

9- To what extent do you think is it important that students are educated about the rules and regulations of the university?

- Very Important.
- Important.
- Neutral.
- Unimportant.
- Very Unimportant.

10- Do you think the above-mentioned preparation (mentioned in the above question) would avert you from misbehaving in the classroom?

- Yes.
- No.
- I don't know.

11- To what extent do you think is it important that students are educated about distance-learning technologies?

- Very Important.
- Important.
- Neutral.
- Unimportant.
- Very Unimportant.

12- Do you think the above-mentioned preparation (mentioned in the above question) would avert you from misbehaving in the classroom?

- Yes.
- No.
- I don't know.

13- Do you ever have any discipline problems in these classrooms?

- Yes (go to question 14 and 15).
- No (go to the next section, demographical information).

14- Were you ever punished for this?

- Yes.
- No.

15- What are the possible reasons that pushed you to create these problems?

- A break in routine.
- The length of the lecture.
- The lecture was dull.
- The lecturer could not see you.
- The unavailability of assistance.
- The assistant could not see you.
- The assistant could not punish you.
- Other (please specify) .....

**Personal Information**

- Name.....
- Age.....
- Number of subject you have attended before with males instructors through distance-learning technologies.....
- GPA.....
- Major.....
- Subject you are enrolled in during filling this questionnaire.....

### APPENDIX 3-N

أهمية إعداد الطالبات في الحد من مشاكل الانضباط في فصول التعلم عن بعد في جامعة الملك سعود

الغرض من هذا الاستبيان هو التعرف على الجهود الحالية التي تبذلها جامعة الملك سعود و المعلمين الذكور في توفير الإعداد المناسب للطالبات قبل التحاقهم بفصول التعلم عن بعد ودور هذا الإعداد في الحد من مشاكل الانضباط في الفصول الدراسية للتعلم عن بعد في جامعة الملك سعود.

الإعداد في هذا السياق يتعلق بجانبين مهمين: الأول هو خلق الوعي بين الطالبات حول تكنولوجيا التعلم عن بعد ، على سبيل المثال ، مزايا وقيود هذه التكنولوجيا ، الاختلافات بين الفصول المستخدمة فيها هذه التكنولوجيا وبين الفصول الدراسية التقليدية وسبل التعامل والتواصل مع المعلمين الذكور. ثانيا هو خلق الوعي بين الطالبات حول القواعد و الأنظمة المعمول بها في الجامعة بشأن إدارة سلوك الطالبات و ما عواقب كسر هذه القواعد . نتاج هذا الاستبيان ستوفر نظرة ثاقبة حول هذا النوع من الإعداد و الجهود الحالية للجامعة والمعلمين في هذا الصدد. يهدف هذا الاستبيان أيضا إلى تحديد بعض الأسباب التي تدفع الطالبات للسلوك السيء في هذه الفصول الدراسية.

طول هذه الاستبيان هو أربع صفحات. الباحثة سوف تكون جدا ممتنة إذا أمكن أن تتحققى من أن كل الصفحات تمت تعبنتها بشكل مناسب قبل إعادة الاستبيان.

- هل حضرت أي شكل من أشكال التعلم عن بعد قبل أن تنضمي إلى الجامعة؟  
 نعم .  
 لا.
- بعد التحاقك بالجامعة ، هل كانت هناك أية جهود بذلت لخلق الوعي بين الطالبات حول القواعد و الأنظمة المعمول بها في الجامعة بشأن إدارة سلوك الطالبات أو ما عواقب كسر هذه القواعد؟  
 نعم من قبل الجامعة (أذهب إلى السؤال الثالث والرابع والخامس ) .  
 نعم من قبل المدرب (أذهب إلى السؤال السادس والسابع) .  
 لا (أذهب إلى السؤال الثامن).
- كيف كانت أشكال هذه الجهود ؟  
 المكتبات.  
 الندوات ( أقل من 20 شخصا ) .  
 المحاضرات (أكثر من 20 شخصا ) .  
 لوحات الاعلانات.  
 أشياء أخرى.....
- من وجهة نظرك ، هل كانت هذه الجهود كافية لتتقيد الطالبات حول قواعد وأنظمة الجامعة؟  
 نعم .  
 لا.
- هل هذا النوع من الإعداد يمنعك من إساءة التصرف أو تعطيل الصف؟  
 نعم .  
 لا.
- هل هذا النوع من الإعداد المقدم من قبل المعلمين الذكور يمنعك من إساءة التصرف أو تعطيل الصف؟  
 نعم .  
 لا.
- هل طبق المعلم أي أساليب مفيدة لإدارة مشاكل الانضباط في الفصول الدراسية ؟  
 نعم، (يرجى تقديم مثال لمثل هذه الأساليب ) .....  
 لا.
- هل كانت هناك أية جهود بذلت لخلق الوعي بين الطالبات حول تكنولوجيا التعلم عن بعد، على سبيل المثال مزايا وقيود هذه التكنولوجيا، الاختلافات بين الفصول المستخدمة فيها هذه التكنولوجيا وبين الفصول الدراسية التقليدية وسبل التعامل والتواصل مع المعلمين الذكور؟  
 نعم من قبل الجامعة ( ما هو شكل هذه الجهود ..... ) .  
 نعم من قبل المعلم ( ما هو شكل هذه الجهود..... ) .  
 لا.
- إلى أي مدى تعتقدين أنه من المهم أن يتم توعية الطالبات حول القواعد و الأنظمة المعمول بها في الجامعة؟  
 مهم جدا.  
 مهم  
 محايد  
 غير مهم.

- غير مهم جدا.
- هل تعتقد أن الإعداد المذكور أعلاه (المذكور في السؤال أعلاه) تمنعك من إساءة التصرف في الفصول الدراسية ؟  
 نعم  
 لا  
 أنا لا أعرف.
- إلى أي مدى تعتقد أنه من المهم أن يتم توعية الطالبات حول تكنولوجيا التعلم عن بعد ؟  
 مهم جدا.  
 مهم  
 محايد  
 غير مهم.  
 غير مهم جدا.
- هل تعتقد أن الإعداد المذكور أعلاه (المذكور في السؤال أعلاه) تمنعك من إساءة التصرف في الفصول الدراسية ؟  
 نعم .  
 لا  
 أنا لا أعرف.
- هل سبق وقمتي بأي مشاكل انضباط في هذه الفصول الدراسية ؟  
 نعم (أذهب الى السؤال 14 و 15) .  
 لا (انتقل إلى القسم الأخير ، المعلومات الشخصية) .
- هل سبق و عوقبت على أي من هذه المشاكل؟  
 نعم .  
 لا.
- 15 - ما هي الأسباب الممكنة التي دفعتك لخلق هذه المشاكل؟  
 لكسر الروتين .  
 طول المحاضرة.  
 المحاضرة مملة.  
 المعلم لا يستطيع رؤيتي.  
 عدم توفر المشرفة  
 المشرفة لا تراني.  
 المشرفة لا تستطيع معاقبتي  
 أخرى ( يرجى التحديد) .....

معلومات شخصية

الاسم.....  
العمر.....  
عدد المواد التي سبق و درستيها مع المعلمين الذكور من تكنولوجيا التعليم عن بعد.....  
المعدل.....  
التراكمي.....  
التخصص.....  
المادة المسجلة فيها أثناء ملاء هذه الاستبيان.....

## **APPENDIX 3-0**

### **The perceptions of female students towards the CommEasy system**

The aim of this questionnaire is to explore the perceptions of the female students towards the CommEasy system and to what extent the system facilitates and supports their participation with male instructors in the distance-learning classrooms and solving the problems they face in this regard. It also aims to evaluate the system according to some metrics, such as ease of use, ease of download, etc. It further aims to identify the advantages/disadvantages of the system from students' points of views and gather their suggestions and comments to improve the system.

With regards to the CommEasy system that you have used in the participations with the male instructor during the last two weeks, please respond to ALL of the following items by choosing the response that best matches your opinion.

Items	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The system provides a convenient way to communicate with male instructors in the distance-learning classroom					
The system provides a convenient way to pose questions for instructors during the lecture.					
The system provides a convenient way to answer the instructor's questions during the lecture.					
I no longer feel embarrassed to communicate with the male instructor with the CommEasy system.					
I feel more engaged and interested in the learning environment with using CommEasy.					
I participate more with using the CommEasy.					
CommEasy makes communication with male instructors after lecture easy.					
I can participate easily in the crowded classroom using CommEasy system.					
I can participate easily even if I sit far from microphones.					

The system is easy to download (application loads quickly and does not crash)					
The system is easy to run (account can be created easily and quickly)					
The system is easy to use (you can launch and navigate within the app easily)					
The GUI is user-friendly (allowing you to interact with the application in a natural and intuitive way).					
The Help of the system is informative (the system's help page provides useful information).					

- What aspect(s) of the Commeasy system did you like/dislike?
- Do you have any suggestions or comments to improve the system?

**Personal Information**

Name (optional)..... Additional information you would like to mention.....

### APPENDIX 3-P

#### تصورات الطالبات نحو نظام Commeasy

الهدف من هذا الاستبيان هو استكشاف تصورات الطالبات نحو نظام Commeasy وإلى أي مدى يسهل هذا النظام و يدعم مشاركتهن مع المدرسين الذكور في الفصول الدراسية للتعلم عن بعد وحل المشاكل التي تواجههن في هذا الصدد. يهدف الاستبيان أيضا إلى تقييم هذا النظام وفقا لبعض المقاييس ، مثل سهولة الاستخدام وسهولة التحميل وغيرها .يهدف الاستبيان كذلك إلى التعرف على مزايا / عيوب النظام من وجهة نظر الطالبات والحصول على تعليقاتهم ومقترحاتهم لتحسين النظام.

فيما يتعلق بنظام Commeasy الذي استخدمته في المشاركة مع المعلم خلال الأسبوعين الماضيين ، يرجى الرد على كل من العناصر التالية عن طريق اختيار أفضل اجابة تمثل رأيك .

العبرة	أوافق بشدة	أوافق	محايد	لا أوافق	لا أوافق بشدة
النظام يوفر وسيلة مريحة للتواصل مع المعلم في فصول التعليم عن بعد.					
النظام يوفر وسيلة مريحة لطرح الأسئلة على المعلم خلال المحاضرة.					
يوفر النظام وسيلة مريحة للإجابة على أسئلة المعلم خلال المحاضرة.					
أنا لم أعد أشعر بالحرج للتواصل مع المعلم عند استخدام Commeasy .					
أشعر أنني أصبحت أكثر انخراطا واستمتاعا ببيئة التعلم عند استخدام Commeasy .					
أشارك أكثر عند استخدام Commeasy .					
النظام يجعل التواصل مع المعلمين بعد المحاضرة سهل.					
أنا أستطيع أن أشارك بسهولة في الفصول الدراسية المزدحمة باستخدام نظام Commeasy .					
أنا أستطيع أن أشارك بسهولة حتى لو جلست بعيدة عن الميكروفونات.					
النظام سهل التحميل ( التطبيق يتحمل بسرعة ولا يتعطل).					
النظام سهل التشغيل ( الحساب يمكن إنشاؤه بسهولة وبسرعة ).					
النظام سهل الاستخدام (يمكنك تشغيل النظام والتنقل فيه بسهولة).					
واجهات النظام صديقة للمستخدم (واجهة المستخدم الرسومية يتيح لك التفاعل مع التطبيق بطريقة سهلة وبديهية).					
المساعدة المقدمة من النظام غنية بالمعلومات ( صفحة المساعدة في النظام تقدم معلومات مفيدة)					
دليل النظام غني بالمعلومات ( دليل التطبيق يقدم معلومات مفيدة)					

- ما هي الجوانب التي أجبنتك/ لم تعجبك في نظام Commeasy؟

.....  
.....  
.....

- هل لديك أي اقتراحات أو تعليقات لتحسين النظام؟

.....  
.....  
.....

معلومات شخصية

اسم (اختياري) .....

المعلومات الإضافية التي تودين ذكرها.....

### **APPENDIX 3-Q**

#### **The perceptions of the male instructors towards the Commeasy system**

The aim of this questionnaire is to explore the perceptions of the male instructors towards the Commeasy system and to what extent the system facilitates the communication between them and their students in distance-learning classrooms. It also aims to evaluate the system according to some metrics, such as ease of use, ease of download, etc. It further aims to identify the advantages/disadvantages of the system from instructors' points of view and gather their suggestions and comments to improve the system.

With regards to the Commeasy system that you have used in the communication with the students during the last two weeks, please respond to ALL of the following items by choosing the response that best matches your opinion.

Items	<b>Strongly Agree</b>	<b>Agree</b>	Neutral	Disagree	<b>Strongly Disagree</b>
The system provides a convenient way to communicate with female students.					
The system provides a convenient way to receive questions from students					
The system provides a convenient way to answer the students' questions					
The system help instructors to evaluate students' learning.					
The system promotes students participation in the classroom.					
The system is easy to download (application loads quickly and does not crash)					
The system is easy to run (account can be created easily and quickly)					
The system is easy to use (you can launch and navigate within the app easily)					
The system is user friendly (the GUI is functional and visually stimulating).					
The Help of the system is informative (the system's help page provides useful information).					

What particular aspect(s) of the Commeasy system did you like/dislike?

Do you have any suggestions or comments to improve the system?

**Personal Information**

Name (optional).....

Department .....

Additional information you would like to mention.....

### APPENDIX 3-R

#### تصورات المعلمين الذكور نحو نظام Commeasy

الهدف من هذا الاستبيان هو استكشاف تصورات المعلمين الذكور نحو نظام Commeasy وإلى أي مدى يسهل هذا النظام التواصل بينهم وبين طالباتهم في الفصول الدراسية للتعلم عن بعد . كما يهدف أيضا إلى تقييم النظام وفقا لبعض المقاييس ، مثل سهولة الاستخدام وسهولة التحميل وغيرها ويهدف كذلك إلى التعرف على مزايا / عيوب النظام من وجهة نظر المعلمين و الحصول على مقترحاتهم وتعليقاتهم لتحسين النظام.

فيما يتعلق بنظام Commeasy التي استخدمته في التواصل مع الطالبات خلال الأسبوعين الماضيين ، يرجى الرد على كل من العناصر التالية عن طريق اختيار أفضل اجابة تمثل رأيك .

العبرة	أوافق بشدة	أوافق	محايد	لا أوافق	لا أوافق بشدة
يوفر النظام وسيلة مريحة للتواصل مع الطالبات .					
يوفر النظام وسيلة مريحة لتلقي الأسئلة من الطالبات.					
يوفر النظام وسيلة مريحة للإجابة على أسئلة الطالبات.					
النظام يساعد المعلم على تقييم تعلم الطالبات في الفصول الدراسية.					
النظام يشجع مشاركة الطلاب في الفصول الدراسية.					
يوفر النظام طريقة سهلة للتواصل مع الطالبات بعد المحاضرة.					
النظام سهل التحميل ( التطبيق يتحمل بسرعة ولا يتعطل)					
النظام سهل التشغيل ( الحساب يمكن إنشاؤه بسهولة وبسرعة ) .					
النظام سهل الاستخدام (يمكنك تشغيل النظام والتنقل فيه بسهولة).					
واجهات النظام صديقة للمستخدم (واجهة المستخدم الرسومية يتيح لك التفاعل مع التطبيق بطريقة سهلة وبديهية).					
المساعدة المقدمة من النظام غنية بالمعلومات ( صفحة المساعدة في النظام تقدم معلومات مفيدة)					
دليل النظام غني بالمعلومات ( دليل التطبيق يقدم معلومات مفيدة)					

- ما وجه الجوانب التي تعجبك/ لاتعجبك في نظام Commeasy؟

.....

.....

- هل لديك أي اقتراحات أو تعليقات لتحسين النظام؟

.....

.....

معلومات شخصية اسم ( اختياري ) ..... المعلومات الإضافية التي تودين ذكرها.....

## **APPENDIX 5-A**

### **The International Classroom Design Guidelines Considered in this Thesis**

Name of Publication	Year of publication
Montana State University Classroom Design Guide	2012
Emory College Classroom Design Guide	2010
Arizona State University Classroom Design Guide	2011
Syracuse University Classroom Design Guide	2011
Designing Spaces for Effective Learning , a Guide to 21 <sup>st</sup> Learning Space Design, Harvard University	2013
A Landmark Gift for Learning, Harvard University	2013
University of Maryland Classroom Design Guide	2004
Georgia Institute of Technology- A Philosophical Approach to Classroom Design - Five Basic Principles.	2009
New York State University – Classroom Design Guidelines.	2010
Classroom Guidelines for the Design and Construction of Classrooms at the University of California, Santa Cruz.	1996
University of Cincinnati- Design Guidance: Learning Environments	2003
The University California, San Diego- General AV Guidelines	2012
University OF Washington- Design Guide	2002

## **APPENDIX 5-B**

Microphone companies such as the Shure Incorporated Company and Crown Audio Company have provided many guidelines for designing microphones in distance-learning classrooms, example of these are:

- <http://www.crownaudio.com/mictip2.htm>;
- <https://www.audiolinks.com/AKG.shtml>;
- <https://www.audiolinks.com/anchor.shtml>;
- <https://www.audiolinks.com/Shure.shtml>;
- <https://www.audiolinks.com/Fender.shtml>;
- <https://www.audiolinks.com/tek9/tek9.asp?pg=products&grp=741&manuf=28>;
- <https://www.audiolinks.com/sennheiser.shtml>;
- <https://www.audiolinks.com/Shure.shtml>;
- [http://www.shure.co.uk/support\\_download/downloads/pdf-guides](http://www.shure.co.uk/support_download/downloads/pdf-guides);
- <https://microphones.audiolinks.com/microphones.shtml>

## **APPENDIX 5-C**

### **List of Strategies for the Effective Design of Distance-Learning Classrooms**

Strategy Number	Descriptions of Strategy
<b>Classroom Physical Design</b>	
Str1	Make the student-to-microphone distance as small as possible. Place microphones no more than 2 feet from the students.
Str2	Microphones with flat surfaces are not recommended if the students are likely to be shuffling books and papers on their desks during the lecture; this might cause the microphone to pick up muffled sounds or rustling noises.
Str3	The use of gooseneck microphones is recommended if students are likely to be shuffling books and papers on their desks during the lecture because it elevates the sensitive part of the microphone above the surface of the desk, closer to the student and further from desktop noise.
Str4	Use unidirectional microphones because these microphones are designed to be more sensitive to sounds coming from one direction and they have also been designed to rejected sound-related problems such as feedback, background noise and reverberation. There are many examples of the unidirectional microphones; the most popular are cardioid, super-cardioid, and hyper-cardioid microphones.
Str5	Choose hyper-cardioid microphones as they offer maximum rejection of reverberation, feedback, and background noise than other unidirectional microphones types.
Str6	Avoid omni-directional microphones; these cause sound-related problems such as feedback.
Str7	Only one microphone should be active at a given time; use either automatic microphone mixers or push-to-talk microphones.
Str8	Use lavalier microphones for the students, if placing microphones on students' desks is not possible for any reason and guide students on how to use them (e.g. place the microphones on your blouse, about 8 inches below your chin).
Str9	Allow one microphone per two to three students.
Str10	Avoid suspending the microphones from the ceiling as this is one of the worst places for location of microphones. If did so, it should be combined with excellent room acoustics.
Str11	Check the microphones once a week to ensure that they are in good working order.
Str12	One projection screen or television is enough for seminar rooms containing up to 20 students.
Str13	Two projection screens (televisions) are required for classrooms.
Str14	Tow projection screens (televisions) are required for auditorium.
Str15	The minimum height of the projection screen is 20% of the distance to the seat farthest away from the screen.
Str16	The minimum width for projection screens can be determined by using the aspect ratio - the width of the screen to the height (4:3 for CRT technology and 16:9 for HD technology).
Str17	The size of the television(s) in the distance-learning classroom should be one inch for each foot of distance between the farthest student and the screen.
Str18	If possible, use a larger television size in the distance-learning classroom to allow students

	to be more comfortable and feel more in touch with the instructor.
Str19	“The top of the screen should be no greater than 35 degrees from the horizontal for any seating position” (Clabaugh, 2004, p.21).
Str20	“The center of the screen should be no greater than 45 degrees from the vertical for any seating position” (Clabaugh, 2004, p. 21).
Str21	The bottom of the screen should be placed at least 6 feet from the floor.
Str22	The minimum distance between projection screen or televisions and the closest seats in a classroom should be no less than 9 feet.
Str23	Replace CRT televisions with auxiliary flat-panel HD televisions.
Str24	use voice amplification systems in classroom (over 75 students) and in auditoriums.
Str25	Choose loudspeakers that have a uniform response among the entire range of speech frequencies.
Str26	Choose loudspeakers that radiate sound uniformly over a wide coverage angle (angle of 140° or more is ideal).
Str27	Take the loudspeaker-to-student distances into account: it is advisable to maintain a sufficient distance between the students and the loudspeakers. It is possible to achieve this by adhering to the distance ratio of around 2:1 or less. It is advisable to avoid distance ratios over the range of 3:1.
Str28	Wall-mounted loudspeakers should be placed at a height of approximately 2.4 to 2.8 metres above the floor to prevent sound-related problems, such as feedback.
Str29	Make the loudspeaker-to-microphone distance as large as possible in the classroom.
Str30	Place loudspeakers behind the directional microphones for better sound quality in the classroom
Str31	In the broadcast studio, use one HD camera, pointed at the instructor’s face, in addition to the document camera for the materials being presented.
Str32	In the broadcast studio, the cameras should be installed in places where the viewing angles are appropriate, so that the transferred images are as natural as possible
Str33	Ceiling lights should be bright and angled to provide good detail in instructor’s face and avoid dark shadows, especially under the eyes
<b>Classroom Physical Features</b>	
Str34	Locate the learning classroom no more than one floor up or one floor down from the building entrance/exit to provide easy access to the classroom.
Str35	Locate the learning room away from all noise sources such as cafeterias, stairs and elevators.
Str36	Make the circulation space outside the learning room large enough to facilitate students’ movements and to accommodate the number of students waiting for the next lecture (allow at least 3SF per student)
Str37	Size the seminar room in a 2:3 or 3:4 width to length ratio.
Str38	Size the classroom and auditorium room with a length dimension of approximately 1.5-2 times the width (rooms wider than they are long providing unacceptable viewing angles for screens in the classroom).

Str39	Provide 30-40% additional square feet to the above-mentioned size for the room that will be used for distance learning.
Str40	Consider viewing angles when determining the shape of the learning room; all students should have good viewing angles for the screens.
Str41	Avoid classrooms and auditorium that are either too wide or too deep.
Str42	Avoid long and rectangular shapes for the seminar room.
Str43	Use a room that is nearly square for seminar rooms and classrooms; this shape providing good sight lines.
Str44	Use a fan shape or a shape based on 'viewing angles' from projection screens for a large auditorium of over 200 students.
Str45	Use rectangular shapes for the distance learning room; this shape is more appropriate for proper viewing angles and acoustics than are square shapes.
Str46	The use of one door for the seminar room and classroom up to 85, however, two doors is preferable for the classroom as it will be more beneficial in facilitating students' movements and in accommodating the movements of classroom equipment into and out of the room
Str47	For larger classrooms (above 85) and auditorium, it is recommended to have two doors as this will be beneficial in facilitating students' movements and accommodating movements of classroom equipment into and out of the room
Str48	Locate the door either at the side or the rear of the learning classroom, especially in the case of a distance-learning classroom. This would help latecomers enter and get a seat without disturbing the work of the rest of the class and so makes the in and out movement of students easier and much less noisy.
Str49	The width of the door should be at least 3 ft., while the height should be approximately 8 ft.
Str50	The door should open into the learning room, rather than into the hallway. If the door must unavoidably open to the outside, the opening space of the door should be clearly marked.
Str51	If a door opens into the hallway, a sign should be hung to warn the students, or the floor tiles should be arranged in a manner to indicate the extent to which the door will open.
Str52	The doors should have bolts attached to keep them open, in order to avoid congestion at peak times.
Str53	An entrance alcove should be provided for doors of auditorium rooms. The alcove should be large enough and use noise reduction and light restriction materials in its design.
Str54	The doors should have vision panels, preferably made of shatter-resistant glass.
Str55	The vision panel should be a minimum of 2 SF and tinted to limit the spread of light.
Str56	It is recommended that if vision panels are not used, glass sidelights should be provided alongside doors. Sidelights should be either full height or start three ft. above the floor to allow easy access for wheelchair users as well as for student who are standing.
Str57	Both vision panels and sidelights used in the door must be placed so that any outside light will not affect the projection screens in the learning classroom (for example, placed in or near doors at the rear of the classroom, but not at the front of the classroom).
Str58	Use levers (not knobs) in door for easier use by students with disabilities.
Str59	Use of an additional electric-powered door opener is also recommended.

Str60	Use deadbolt locks that are card-activated if locks are required on the door.
Str61	“Use door hardware that results in a slow and quiet closure to a tight sound seal when fully closed” (Clabaugh, 2004, p.6).
Str62	Avoid ventilation louvers in the door, as it will allow outside noise to disturb the classroom environment
Str63	Place kick plates on the outer side of doors to prevent scratches and protect them from collisions.
Str64	Number the doors for easy identification by students and instructors.
Str65	Door prefer to be outside the camera’s viewing range in the distance learning classroom.
Str66	The minimum ceiling height for a seminar room with a flat floor is 8 ft.
Str67	The minimum ceiling height for a classroom (21-85 students) with a flat floor is 9 ft. but preferably 13 ft.
Str68	The minimum ceiling height for a classroom containing 86-149 students with a tiered floor is 14 ft. at the front, and 9 ft. minimum at the rear.
Str69	The minimum ceiling height for a classroom of 150-299 students with a tiered floor is 15 ft.at the front and 9 ft. minimum at the rear.
Str70	The minimum ceiling height for an auditorium with a tiered floor is 18 ft. at the front and 9 ft. minimum at the rear.
Str71	Use sound-absorbing acoustical tiles to cover ceilings, , Noise Reducing Coefficient (NRC) between .65 and .85 should be met, to reduce reflections and other sound related problems especially in distance-learning room.
Str72	All ceiling specifications such as being moisture resistant, optimum hygiene, fire protection, aesthetics, etc. should be taken into consideration in designing the ceiling.
Str73	Use a flat floor in both the seating area and the instructor area for seminar rooms and classrooms (21 to 85 students).
Str74	Avoid adding raised platforms at the front of the room because this will create access problems for students in wheelchairs
Str75	Use either sloped or tiered floors in large classroom (above 86 students) and auditoriums because these provide good sight lines to screens.
Str76	The front of the large auditorium, with either a sloped floor or tiered floor, should include a proper sized flat floor to provide easy access for students in wheelchairs.
Str77	Room entrances should be barrier-free to allow easy access for wheelchair users and to allow the free movement of equipment carts.
Str78	Floor can be covered with vinyl composition tiles or rubber tiles. These are characterised by many advantages, such as reasonable cost, easy maintenance and a livelier look than a carpet.
Str79	Floors can be covered with many types of industrial-grade, stain-resistant carpets that are commonly used in many universities worldwide. This offers valuable acoustical features to the room, an aspect that is especially important in distance-learning classrooms.
Str80	The carpeted floor should be smooth and free of wiring and cords, to facilitate students’ movements in the room.
Str81	Avoid too darkly coloured carpets as they will quickly look dirty.

Str82	Use medium to light colour for carpet, such as Beige.
Str83	Allow four-inch to six-inch cove installed around all the walls of the room.
Str84	Walls should be designed with Sound Transmission Coefficient (STC) ratings of 50 to efficiently decrease or block the intruding noise.
Str85	In order to reduce the noise levels and to enhance security, it is advisable to extend the walls to the floor above or over the construction of the roof rather than stopping them at ceiling level.
Str86	Special wall-construction details and a higher STC rating are required if the classroom is near noise-generating locations, such as elevators, mechanical rooms, music rooms.
Str87	Concrete masonry units can be used as structural walls, but should be covered with another finish in order to provide good acoustics, especially in the distance-learning rooms.
Str88	All finished materials used in the learning classroom should be durable, easily cleaned and well maintained.
Str89	It is preferable that walls be painted in a light colour in all learning classrooms with the exception of distance-learning classrooms.
Str90	The colour of the wall at the front of the classroom behind the projection screens should be darker than other areas to reduce light reflection when media projectors are in use.
Str91	The colour of furnishings and the audio-visual components in the learning classroom should be coordinated with the finished colours of the classroom, building and university campus (neutral colours being preferred).
Str92	The finishing of walls and furniture should be in neutral colors within a distance learning room, with ample use of neutral blues or greys for the walls and background surfaces of cameras.
Str93	Evaluate the location of the windows in relation to natural light. Windows should face a direction that makes it easy to control light in the classroom and provide adequate blackout capability.
Str94	Windows should be located away from the walls close to noisy yards, exhaust fans and student walkways among others.
Str95	Windows should be located at the sides of the room rather than at the front or rear.
Str96	All windows should be operable.
Str97	Outward opening windows are preferable to inward opening ones.
Str98	Minimise the amount of glass surfaces used in windows.
Str99	A windowless learning classroom is recommended for distance-learning.
Str100	Use classroom darkening roller shades such as Draper Dual Roller Flexshade, to allow the distance learning classroom to be completely darkened.
Str101	Avoid sheer curtains or standard vertical or horizontal blinds, especially in the distance learning room.
Str102	The window covering can be manually operated if the windows are accessible. If not, coverings should be motorized with controls located at an accessible location.
Str103	Ensure that all students have good sight lines to screens when determining the seating arrangement in the classroom.

Str104	Use one fixed table (square-shaped, circle-shaped, boat-shaped, etc.) and movable seats for the seminar room.
Str105	Provide 25 to 27 square ft. for each student in the seminar room.
Str106	Use individual tables with movable chairs in a classroom of up to 50 students.
Str107	Provide 20 to 22 square ft. for each student in a classroom of up to 50 students.
Str108	“Use continuous fixed work surfaces, and upholstered movable chairs in classroom with 51 to 199 students” (Thurnquist, 2009, p.17).
Str109	Provide 18 to 20 square ft. for each student in a classroom of 51 to 199 students.
Str110	“Use continuous fixed work surfaces, and upholstered movable chairs with adjustable-height seats and backs in auditoriums with 200-399 students” (Thurnquist, 2009, p.17).
Str111	Provide 16 to 18 square ft. for each student in the auditorium with 200-399 students.
Str112	Use tablet-arms seats in auditoriums with more than 400 students, to reduce room depth and costs.
Str113	Provide 14 -16 square ft. for each student in auditoriums with more than 400 students.
Str114	Use layouts consisting of a gentle arc or U-shape, oriented towards screens in auditoriums containing over 200 students.
Str115	Allow a work surface of about 4 sq. ft. of usable space for each student in one unobstructed area.
Str116	Minimum dimensions for work surfaces in a seminar room with movable desks or with fixed table is 20 inches deep and 28 inches wide.
Str117	Minimum dimensions for work surfaces in a classroom with movable desks is 20 inches deep and 28 inches wide.
Str118	Minimum dimensions for work surfaces in a classroom and an auditorium with continuous work surfaces is 18 inches deep and 28 to 30 inches wide.
Str119	“Allow unobstructed knee clearance space underneath work surfaces that is at least 22 inches wide and 27 inches high” (Thurnquist, 2009, p.25).
Str120	All work surfaces in the classroom should be designed to accommodate right and left-handed students.
Str121	Provided appropriately sized workstations of at least 36 inches wide for wheelchair students.
Str122	Allow at least 2 workstations for wheelchair students in the learning rooms
Str123	Provide students with comfortable seats that offer excellent ergonomics; seats and backrests should have an articulating movement.
Str124	Avoid armrests and using armless task chairs.
Str125	In terms of seat spacing, provide a minimum of 28 inches in the centre of the learning classroom with movable desk or with continuous work surfaces.
Str126	In terms of tablet-arm seats, the seats spaces should be a minimum of 24 inches at the centre.
Str127	All main aisles leading to the instructor’s area and to the door should be at least 36 inches wide.

Str128	Aisles behind seats in use should be at least 15 inches wide.
Str129	The area in front of the room that includes the instructor area should be at least 9 ft from the front wall of the room to the first row of seats.
Str130	It is important to design the lighting and electrical power systems to be energy-efficient.
Str131	It is important that the lighting and electrical power systems are easily maintained and modified.
Str132	Light controls should be placed at convenient locations and labelled clearly according to their function.
Str133	Use indirect or parabolic fluorescent lights.
Str134	Avoid locating lights behind the instructor area.
Str135	Use lighting controls that automatically turn off lights in unoccupied rooms.
Str136	Avoid natural lighting from windows in distance learning rooms.
Str137	In distance-learning rooms with cameras, use horizontal lighting for cameras and overhead lighting for students.
Str138	In distance-learning rooms with cameras, the level of lighting should be minimized as much as possible, to 50 foot-candles on horizontal surfaces and 35 foot-candles on vertical surfaces.
Str139	The lighting system (especially the fluorescent light fixtures) should be checked regularly by an electrician.
Str140	Use advanced ventilation and air conditioning facilities in the distance learning room to protect the equipment from overheating and to avoid increases in the classroom temperature.
Str141	Air conditioning should be year-round, to handle the heat and humidity.
Str142	Noise-controlled (HVAC) systems should be selected in the initial design of the classroom, as this will have a large impact on the reduction and elimination of noise.
Str143	The reverberation time (RT) should be 1.00 second in a traditional classroom, or no more than 1.2 seconds.
Str144	The reverberation time (RT) should be 0.6 to 0.75 seconds for distance learning rooms.
Str145	The noise level in empty room should be 30 to 35dB.
Str146	The signal-to-noise ratio should be +15dB above the background noise for both traditional and distance learning classrooms.
Str147	Improve the room's acoustics; e.g. use carpeted flooring, use acoustic tile ceilings and a curtain with a heavy weight or fullness over the windows and sound absorbers on walls. These will have a significant impact on increasing the audio clarity, especially in the distance learning room.
Str148	Use quiet fans and duct insulation to reduce the noise level of HVAC systems.
Str149	Place absorbent pads underneath furniture, using rubber tips on the legs of desks and chairs and regularly maintaining the ballasts in fluorescent lights to reduce level of noise in the classroom.
Str150	Use background noise cancellers in the distance learning room.
Str151	Use acoustic echo cancellers (AEC) that sense echoes and cancel them out; use one for each distance learning room.

Str152	Use proper wiring of the sound system and replace telephonic equipment when required, to eliminate feedback problems in the audio in distance learning room.
Str153	Remove cable wires that run from the equipment across the floor because students might stumble on these wires.
Str154	All furniture in the learning room, such as carpets, should be easily cleanable and replaceable when required.
Str155	The learning room should contain suitable-sized trash cans located near the doors.
Str156	The learning room should be cleaned at least once a day; e.g. after all lectures are finished.
<b>Technical Support in the Classroom</b>	
Str157	Activate a maintenance agreement for classroom equipment with a maintenance provider.
Str158	Use issue tracking system software, which is an effective way to deal with and solve technical problems.
Str159	Use the help desk and provide effective ways for contacting the help desk staff; for example, by telephone, email, and a website.
Str160	The help desk contact information should be easily obtained; e.g. add this information to the back of the university card.
Str161	Provide students with a way to report technical problems via the internet; e.g., provide a form on the university website that allows students to provide details of the problem they faced and to send it to the maintenance department
Str162	Check the distance-learning classroom equipment at least once a week to ensure that it is in full working order.
Str163	The technical assistants should be well-qualified (e.g. have a degree in computer science or a computer-related field).
Str164	It is preferable that the technical assistants have basic experience in the field of maintenance, student support and computer software and hardware (at least two years' experience).
Str165	It is preferable that the technical assistants have good oral and written communication skills in addition to skills in how to deal with different users, and the ability to handle stress. These skills are essential when dealing with members of the university who are having technical problems.
Str166	It is preferable that the technical assistants have good skills in terms of problem solving.
<b>Classroom Management</b>	
Str167	The university should organise an introduction programme at the beginning of each term to provide students with a basic understanding of the distance-learning environment.
Str168	The university, as well as instructors, should encourage students to improve their listening skills and provide them with appropriate support and training in this regard.
Str169	The instructor is encouraged to create or build a classroom community from the beginning of a course.
Str170	Instructor is encouraged to send a welcome letter to the students at the first lecture to introduce yourself, give them general background about the environment they will learn in, explain the aim of the subject, what will happen during the term, what topics will be covered, how students will be assessed, the rules that students should be aware of, and what will happen in case such rules are broken.

Str171	Instructor is encouraged to involve students in some activities, in order to allow them to get out of the routine, and to renew their energy during classes.
Str172	Instructor is encouraged to learn the students' names or have an attendance list and try to call on them during lectures to ensure that they stay involved in the classroom.
Str173	Instructor is encouraged to ask students to interact in class, and that it is expected that everyone will participate with the instructor and that participation points will be used
Str174	Instructor is encouraged to give students feedback and comments regularly, as this will reduce their feelings of isolation, and encourage their communication with the lecturer.
Str175	Instructor is encouraged to alter and improve teaching approaches, and apply new strategies and approaches to manage the teaching-learning process
Str176	Instructor is encouraged to give rules and apply the appropriate punishments when required.
Str177	University is encouraged to appoint teaching assistants for the distance-learning classroom to reduce discipline problems in the classroom
Str178	University is encouraged to provide the teaching assistants with appropriate training and support they may need (e.g. workshops to improve their skills in managing order in the classroom).
Str179	Inform students that the sound system will cut off the speaker's transmission when someone talks during lectures, and that the on/off switch can be used during lectures to eliminate or reduce discipline problems.
Str180	Use PRS technology to keep students involved in useful discussion and answering questions posed by instructors through the lectures; this will help to keep student attention during lectures and reduce discipline problems

## **APPENDIX 6-A**

### **Desired Features of the CommEasy**

- CommEasy should include two applications: one for students and another for instructors.
- Students and instructors should be able to contact each other simultaneously through their own applications (e.g. send questions and receive answers simultaneously).
- CommEasy should support iOS devices (iPhone and iPad) and be based on internet and wifi technology for communication between the applications.
- CommEasy should maintain students' anonymity.
- The instructor application should support the following features:
  - Instructors should be able to sign up for the application.
  - Instructors should be able to login to the application.
  - Instructors should be able to logout from their account.
  - Instructors should be able to create new classrooms with venue, date and time.
  - Instructors should be able to receive text-based questions from their students.
  - Instructors should be able to post text-based answers to the questions sent by their students.
  - Instructors should be able to create questions with multiple-choice answers and send them to their students.
  - Instructors should be able to browse the voting results.
  - Instructors should be able post course announcements to their students.
- The student application should support the following features:\ul style="list-style-type: none;">- Students should be able to sign up for the application.
- Students should be able to login to the application.
- Students should be able to logout from their account.
- Students should be able to join the classroom created by their instructors.
- Students should be able to post text-based questions to their instructors.
- Students should be able to receive answers for the questions sent to their instructors.
- Students should be able to respond to the multiple-choice questions sent by their instructors.
- Students should be able to leave the classroom when desired.
- Students should be able to browse all the classrooms they have joined.
- Students should be able to view all questions sent by their peers.
- Students should be able to view all answers sent by instructors for peer questions.
- Students should be able to join more than one classroom through their application.

## **APPENDIX 6-B**

<b>Req id</b>	<b>Requirement</b>	<b>Type</b>	<b>Dependencies</b>
1	Sign up	Business	
1.1	CommEasy should allow users (students/instructors) to register to the system through signup screen. They will enter their login details, i.e. email and password.	User	
1.2	If signup details are not valid, e.g. incomplete email, the system must reject the details and an appropriate error message should appear.	Business	
1.3	After entering the valid signup details, the system must save the user login details.	Business	
1.4	On successful sign up, CommEasy must present the users with a success message.	User	1.3
2	Login/Logout	Business	
2.1	CommEasy should allow registered users to login to the system with their chosen email and password through a login screen.	User	1
2.2	CommEasy should allow users to remember their login details by using the 'Remember Me' feature.	User	
2.3	On successful login, CommEasy must present the users with a success message.	User	2.1
2.4	CommEasy should allow users to reset their password if they want.		2.1
2.4	CommEasy should allow users to logout at any time.	User	2.3
3	Create /Join and Leave Classroom	Business	
3.1	CommEasy should allow the instructor to create a new virtual class.	User	2.3
3.2	CommEasy should generate a unique access key for the newly created class and provide the instructor with a success message including the access key.	Business	3.1
3.3	CommEasy should allow the instructor to add topics for each class.	User	3.2
3.4	On successfully adding a topic, CommEasy must present the instructor with the success message.	User	3.3
3.5	CommEasy should allow students to join a class using the unique access key.	User	3.1
3.6	If a student enters an invalid access key, the system must reject the key and an appropriate message should appear.	Business	
3.7	On successful joining, CommEasy presents the student with a welcome message.	User	3.5
3.8	CommEasy should allow students to join more than one class with their respective access keys.		3.1
3.9	CommEasy should save a list of all classes a student has joined in the Work Room screen.	User	3.5
3.10	If a student tries to join the class again, a class already joined message should be presented to the student.	User	3.7
3.11	CommEasy should allow students to leave (delete) any class from the Work Rooms screen.	User	3.5
4	View Classes	Business	
4.1	CommEasy must allow the instructor to view all created classes in the Work Room screen.	User	3.1
4.2	CommEasy must allow students to view all joined classes in the Work Room screen.		3.5
5	Post/View Questions	Business	

5.1	CommEasy should allow students to post their text-based questions to the instructor.	User	3.5
5.2	CommEasy should allow students to choose a topic for their questions from a drop down menu.	User	
5.3	If a student does not choose a topic for a question CommEasy should give a warning message.	User	
5.4	On successful posting a question, CommEasy presents the student with a success message.	User	5.1
5.5	CommEasy should allow students to view all questions posted by their peers.	User	
5.6	CommEasy should not allow students to amend or change the posted questions.	Business	5.4
6	Receive/Answer Questions	Business	
6.1	CommEasy should allow the instructor to receive questions posted by their students.		5.4
6.2	CommEasy should not allow the instructor to change questions received from their students.	Business	
6.3	CommEasy should notify the instructor when new questions are received.	User	5.4
6.4	CommEasy should allow the instructor to post a text-based answer for the students' questions.	User	6.1
6.5	On successful posting an answer, CommEasy presents the instructor with a success message.	User	6.4
6.6	All questions already answered by the instructor should disappear from the list of outstanding questions.		6.5
6.7	CommEasy should allow the instructor to amend or change the answer of the question if required.		6.5
7	View/ Receive Answers	Business	
7.1	CommEasy should allow student to receive a text-based answer for the questions after it has been answered by their instructor.	User	6.5
7.2	CommEasy should not allow student to amend /change the answer received.	Business	
7.3	CommEasy should allow student to distinguish the questions already answered from those not yet answered.	User	6.5
7.4	CommEasy should allow student to view all answers for the questions posted by their peers.	User	6.5
7.5	CommEasy should not allow students to amend/change the answers received for the questions posted by their peers.	Business	
8	Create/View Voting Questions	Business	
8.1	CommEasy should allow the instructor to create a new voting question with multiple choice answers.	User	3.1
8.2	CommEasy should allow student to view a list of voting created by the instructor.	User	8.1
9	Answer/View Voting Results	Business	
9.1	CommEasy should allow student to answer voting sent by the instructor.	User	8.2
9.2	CommEasy should allow students to answer each voting once.	Business	
9.3	Voting already answered should disappear from the list of voting in the students' application.	User	9.1
9.4	CommEasy should allow the instructor to view the results of votes.	User	
9.5	The results of the voting must be presented in an appropriate format.	Business	
10	Post/View Announcement	Business	
10.1	CommEasy should allow the instructor to post an announcement for the class.	User	3.1
10.2	CommEasy should allow student to view a list of announcements	User	10.1

	posted by the instructor in each class.		
10.3	CommEasy should allow student to view details of each announcement posted by the instructor.		10.1
10.4	CommEasy should not allow student to amend/change the announcements.	Business	
11	<b>View/Retrieve classes in Knowledge Base</b>	<b>Business</b>	
11.1	CommEasy must allow student to view all classes that have previously joined in the Knowledge Base screen, even classes that have been deleted from the Work Rooms screen.	User	3.7
11.2	CommEasy should not allow student to leave (delete) any classes in the Knowledge Base screen.	Business	11.1
11.3	CommEasy should allow student to retrieve any classes from the Knowledge Base screen to the Work Rooms again.	User	3.11
12	<b>View Help</b>	<b>Business</b>	
12.1	User should be able to view the FAQ in the Help screen.	User	
12.2	User should be able to view the contact information in the Help screen.	User	

## **APPENDIX 6-C**

### **Evaluation Questionnaire**

With regards to the instructor application that you have used, the following table lists all the functionalities provided by the application. If you faced any errors (problems) in any of these functionalities during testing the system, please check 'Yes' and provide error details, otherwise check 'No'.

Statements	<i>Yes</i>	<i>No</i>	Comments
Sign up			
Login			
Logout			
Reset Password			
Remember Password			
Create Classrooms			
View Classrooms			
Receive New Questions			
View Questions			
Answer Question			
Create Voting Questions			
View Voting Results			
Create Announcement			
View Help			

In a similar manner to your assessment of the functionalities, please evaluate the other aspects of the application that are listed in the table below. Again, choose 'Yes' or 'No' and provide details if possible.

Statements	<i>Yes</i>	<i>No</i>	Comments
Is the application easy to download (application loads quickly and does not crash)?			
Is the application easy to run (account can be created easily and quickly)?			
Is the application easy to use?			
Is the user interface easy to understand?			
Is it easy to navigate through the application?			
Is the Help of the system informative?			
Is the manual of the system informative?			

- What aspect(s) of the Commeasy system did you like/dislike?  
.....
- Do you have any suggestions or comments to improve the system?  
.....

**Personal Information**

Name (optional).....Additional information you would like to mention.....

## **APPENDIX 6-D**

### **Evaluation Questionnaire**

With regards to the student application that you have used, the following table lists all the functionalities provided by the application. If you faced any errors (problems) in any of these functionalities during testing of the system, please check 'Yes' and provide error details, otherwise check 'No'.

Statements	<i>Yes</i>	<i>No</i>	Comments
Sign up			
Login			
Logout			
Reset Password			
Remember Password			
Join Classrooms			
Leave Classroom			
View Classrooms			
Post Questions			
View Questions			
Receive Answers			
View Answers			
View Voting Questions			
Answer Voting Questions			

View Classes in Knowledge Base			
Retrieve Classes in Knowledge Base			
View Announcement			
View Help			

In a similar manner to your assessment of the functionalities, please evaluate the other aspects of the application that are listed in the table below. Again, choose 'Yes' or 'No' and provide details if possible.

Statements	Yes	No	Comments
Is the application easy to download (application loads quickly and does not crash)?			
Is the application easy to run (account can be created easily and quickly)?			
Is the application easy to use?			
Is the user interface easy to understand?			
Is it easy to navigate through the application?			
Is the Help of the system informative?			
Is the manual of the system informative?			

- What aspect(s) of the Commeasy system did you like/dislike?  
.....
- Do you have any suggestions or comments to improve the system?  
.....

**Personal Information**

Name (optional).....  
Additional information you would like to mention...

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