THE IMPACT OF INFORMATION AND COMMUNICATION TECHNOLOGY ON TEACHING AND LEARNING IN HIGHER EDUCATION AS PERCEIVED BY TEACHERS AND STUDENTS

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A thesis submitted in partial fulfillment of the requirements for the Degree of Master of Philosophy/Science in Management with specialization in Technology Management at the Faculty of Management Sciences
International Islamic University,
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October, 2011

FORWARDING SHEET

The thesis entitled "the impact of information and communication technology on teaching and learning in higher education as perceived by teachers and students" submitted by Ms Afsheen Jalilin partial fulfillment of M.S degree in Management Sciences with specialization in Technology Management, has completed under my guidance and supervision. I am satisfied with the quality of student's research work and allow her to submit this thesis for further process as per IIU rules & regulations.

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Title of Thesis: "Impact of Information and Communication Technology on teaching and learning in higher education as perceived by teachers and students "

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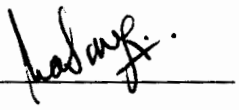

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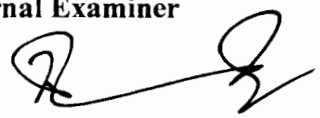

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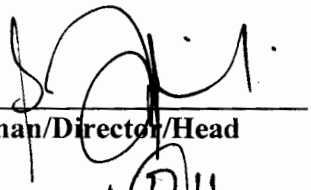

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Date: OCTOBER **2011**

IN THE NAME OF
ALLAH, THE MOST MERCIFUL AND BENEFICENT

Dedication

"To my great parents who are praise worthy for their sustenance of me on right lines because I am today, only due to their untidy efforts for my sake"

ABSTRACT

Higher education is approaching the point at which Information and Communication Technology (ICT), plays a vitalrole in nearly all phases of the educational process. The Internet has emerged asa major driving force of this dynamic development of Information andCommunication Technologies (ICTs) which has impacted positively in virtuallyevery sector of the Pakistani economy. In the education sector, universities use computers in their academic programs in order to produce goodquality of learning and research output. This study focuses on how ICT integration has impacted the higher educational sector positively in Pakistan. The researchalso exposes the effect of ICT integration on both teachers as well as students at higher studies. A combination of observation and data gathering from documented material was employed asmethodology for carrying out this research. The result of the research suggeststhat ICT is becoming a driving force for educational reforms and that ICTs have become an integrative part of education policies and plans at higher education in Pakistan.

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DECLARATION

I hereby declare that this thesis, neither as a whole nor as a part thereof, has been copied out from any source. It is further declared that I have prepared this thesis entirely on the basis of my personal effort made under the sincere guidance of my supervisor. No portion of work, presented in this thesis has been submitted in support of any application for any degree or qualification of this or any other university or institute of learning.

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ACKNOWLEDGEMENT

All the admiration is attributed to "the Allah Almighty", the most merciful, the most compassionate, sole creator of everything, the Devine source of knowledge, inspiration and wisdom, who blessed me with power of thinking and communication, health, sincere and supportive teachers, encouraging family and friends. First of all I would like to submit my profound gratitude to my supervisor Dr Nazir Ahmed Sangi (Vice Chancellor-AIOU) for his consistent encouragement and courageous feedback during completion of this thesis. I am also grateful to Mr Zahid Khan for his continuous support, constructive feedback and patience which helped me a lot to successfully complete this thesis. I present my deep appreciation to my kind teachers for their contribution in my knowledge especially Dr. Bashir,Dr. Usman Raja, and my dear colleagues ShabbarHussain and Fauzia Syed. I am also thankful to all the members of MS/PhD Committee for their guidance to enhance the quality of work in my dissertation. I also deeply thank Mr. Zafar Malik (MS/PhD Program Manager) and Mr. Raja Amjad (Assistant Program Manager) for their continuous support during my stay in this institution.

Afsheen Jalil.

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ABBREVIATIONS

eLearning: Electronic Learning

HEC: Higher Education Commison

ICT: Information Communication Technology

IT: Information Technology

SMS: Short Message Service

SPSS: Statistical Package for Social Sciences

mlearning: Mobile Learning

PDA: Personal Digital Assistants

UNESCO: United Nations Educational, Scientific and Cultural Organization

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CHAPTER 1

INTRODUCTION

1.1.Introduction

In this era of technological advancement, tremendous changes in information and communication technology (ICT) have been witnessed, transforming into an information society. According to Youssef and Dhamani (2008), information and communication technology has become the backbone of a global society, changing every institution, business and individual in a profound way. One of the major trends of educational reform is geared towards use of computer based learning equipment and softwares among the students. The general impression is that integrating technology in learning and teaching is a very valuable asset in the process of learning, appealing to many aspects of students' learning, and hence, a vital necessity for adoption in education. This impression has been echoed by many studies (Tearle, 2004; James, 2008; Oliver, 2001; Newhouse, 2002).

One puzzling question is the effective impact of these technologies on student achievement and on the returns of education. Many academic researchers have tried to answer this question at the theoretical and empirical levels. Nevertheless, the effectiveness of integrating technology into education has been questioned, and challenges have been pointed out by various scholars (Naidu at el., 2002; Zhao & Frank, 2003). Dellit (2002) argue that integrating technology into education is not easy because it is still difficult to afford enough resources to meet the demands.

Carnoy (2004), states that the most troubling gap is teachers' lack of integration understanding. He says that this is because of technology's greatest impact on student learning appears only after teachers have sufficient skills, coupled with an understanding of how various technologies can be used as cognitive tools, and are able to weave technology experiences into their teaching practice. The other major challenge that has been indicated by scholars concerning technology integration in education is the achievement of the process itself (Vannatta & Beyerbach, 2000; Valasidou, 2008; Underwood, 2006)

Creative and new technologies have contributed to increase students as well as teacher's motivation resulting in changed relationships among teachers and students with the knowledge. This includes leaving behind paradigms of teacher as master. Comparing to the new advancement in the learning, it had been termed as more dynamic as teachers and students are partners in creating knowledge and information access had been made very easy. This had also increased the process transparency which had allowed the students to know about thorough feedback. Technologies such as internet and electronic learning has parachuted in such a way that educational institutes have eagerly provided new opportunities for delivering information and resource sharing, to integrate ICTs into their curricula and utilize them in some ways (Sangi & Khattak, 2002).

As a result several researchers and experts had focused to identify and implement new tools and also to have documented the utilization of such tools in the development of learning with huge comparison of the difference between the traditional and new methods. In order to study such difference a better understanding from the teachers as well as students is required to learn (Levine & Schmid, 1998).

1.2. Rationale for the Study

Educational institutions all around the world are beginning to pay greater attention to the improvement of their teaching and learning practices with the innovative use of information and communications technologies. The application of e-mail and computer conferencing, in conjunction with multimedia, databases and electronic libraries, are providing challenging content to enhance the quality of education being delivered using these tools. Quality of education is a critical issue, particularly at a time of educational expansion. But when ICT is taken into consideration, quality improvement has been observed in such a way those students have become more independent and responsible learners through the online course they take, transforming into learner-centered environment (Dellit, 2002; Oliver, 2001; Carnoy, 2004; Zhao & Frank, 2003).

The role of the teacher as sole provider of knowledge has now evolved into a facilitator. With such change and transformation from traditional to digital learning mediums a new horizon for learning had been identified. This had increased the quantity of learning material in the form of text books, audio tapes, visuals, simulations, virtual reality and many other techniques. With the use of extensive technology at the academic institutions the communication barriers between the stakeholders had been reduced which had helped the teachers and students to share lectures, plans, process transparency, video lecturing and other facilities on one platform. This can be said that the link between the technology and development of education system is not a choice but a compulsion. In order to compete in the global arena and to get the excellence factor this is now vital for the educational institutions to adopt such technological advancements.

With globalization and the increasingly dominant role of information and knowledge, providing quality of education is becoming ever more important to address development problems and bridging the information gap. Therefore, there have been efforts by the Government of Pakistan and Higher Education Commission (HEC) to integrate technology on a large scale. These efforts have had a bearing on establishing reforms for ICT integration in higher studies.

1.3.Purpose of the Study

Regardless of the fact that there is relatively abundant research on the technology based learning, like most developing countries, studies on the impact of information and communication technology (ICT) on the education, Pakistan is at sparse. Few factors such as Government policies, lack of funding, institutional problems, infrastructural problems, human capital problems has affected the integration and approach to successful improvement of education system. Since this is the case, it was basically impossible to consider all the factors and conclude on quality education drivers.

Under the light of these facts, the purpose of this study was to investigate and evaluate the use of technology in classroom practices in the universities located in Islamabad, Pakistan. The research looked at what technologies were available, integration of technology in the university curricula (teaching and learning processes) and most important, the stakeholders' perception of their knowledge and skills of technology use.

1.4. Statement of the Problem

"Does the use of information and communication technology enhances teaching and learning as perceived by teacher and students"

1.5. Objectives of the Research

The objectives of this study is to provide insight into teacher and student's ICT competencies, both who are exposed to the same levels of professional development opportunities, have the impact on this range of expertise. Such information could help universities and academic planners for professional development programs and strategically place information and communication technology and resources where they will be used most effectively be used in educational sector.

The objectives of the research are

- To explore the use of information and communication technology (ICT) upon the development of teacher's and students' information literacy.
- To identify those factors having a significant impact of ICT upon of teacher's and students' information literacy.

1.6. Research Significance

At these times of technologically driven lives, developing countries like Pakistan, is encountering the challenges of major reforms in its educational systems. It has become vital to monitor the strategies used to reform education systems through technology integration. The benefits of integrating technology into learning and teaching are numerous and especially at this

time when the country is implementing its Information and Communication Technology. Any research of this nature is important in motivating and trying to streamline reform strategies. It is undeniable that a university is the major research center for all educational levels and the gathering place of scholars and educators. The findings of this study will contribute to the body of ideas and knowledge about better ways or strategies of implementing technology integration in higher education in Pakistan.

1.7 Research Questions

This study seeks to find answers to the following related research questions:

1. What are the teachers and students' perception pertaining to technology usage in teaching and learning activities?
2. How much skill do teachers and students have about technology and technology use?
3. How technology is being used by students and teachers at the universities?
4. What is the status of technology availability and accessibility for teaching and learning at the universities?

CHAPTER 2:

LITERATURE REVIEW

Newhouse (2002) defines technology integration as sustained and meaningful use of an application for the core function of class instruction or learning. He indicates that integration means that instruction moves from initial adoption and one-time demonstration to implementing technology as part and parcel of instruction. He states that technology covers a wide range of applications, lessons, activities, games, and tools, such as personal computers in classrooms, labs, or student homes; handheld devices and video technology. From these definitions of technology integration, becomes clear that adopting and using technology goes beyond the early efforts by schools that concentrated or focused mainly on acquisition and superficial use of technologies. The development of technology integration is changing quickly in all facets of our lives because of the advent of the World Wide Web (WWW) and Internet (Franklin & Sessoms, 2005).

Selwyn (2007) pointed out that, universities are at the 'third phase' of technology integration reform, focusing on technology fluency where students are able to select technology tools to help them obtain information in a timely manner, analyze, and synthesize the information, and present it in a more critical manner. Naidu (2002) indicates that the goal of integrating technology is to link software, media, and technology tools with specific instructional objectives in ways that facilitate teaching and learning.

For many years, educators have focused on technology integration by means of successive innovations. Technology innovation has been a serious concern for educationalists. Great efforts are made to investigate why technologies are not in use and why technology innovations are rejected. However, research has identified a long list of factors that has affected technology integration in academics; one of the factors was the identification of the information and communication technologies which was developed in 1992, and one of the major development was the email services which was used as one of the widely medium of exchange at the workplace. With such huge development had been observed in technology in order to ensure the efficient communication in the academic institutions, (Zhao & Lei, 2003; Zoubi et al., 2007; Haung et al.,2005).

ICT has changed the delivery of educational practices to a greater extend. Institutions have emphasis on adapting the ICT pattern as a part of educational system has focused on additional values that include several functions such as increase in the communication flow, increase cooperation between the parties, greater availability of information, reduction of cost, and other tools (Cox, 2003). During the initial stages ICTs evaluation, various practices were focused, such as needs, attitude towards accepting, implementation of technology and barriers to technology implementation (Davis, 1989; Huang & Liaw, 2005).

Over the years, literature has shown that the technology has helped in improving the learning process, more effectively and efficiently. ICT integration in education has improved the quality by supporting new academic approaches, in which the teacher is more of a "guide on the side" than a "Master on the stage." The prerequisites for using ICT in educational settings, the teachers

should have essential knowledge to guide the students confidently. Faculty now believes in technology with its supportive measures has become essential in teaching practices. Students, on the other hand have started paying attention towards the knowledge of intellectual skills to grasp the technology use and its awareness (Youssef & Dhamani, 2008).

The potential of ICT to improve the quality of learning and teaching is undeniable. This potential has been indicated by numerous researchers (James, 2008; Wills, 2006; Levine & Schmid, 1998; Oliver, 2001) They observed that ICT offers many opportunities to improve learning and that it has the potential to provide people in their own homes and work settings with access to knowledge and learning resources possible until recently only in very large universities. Furthermore, they argued that technology has the potential to make everyone a producer of original knowledge that can be shared with the world at very little cost. Dellit (2002) stated that ICT has made to improve the quality of teaching, learning and evaluation through improvements in pedagogies and culture. The use of ICT not only enhanced the quality of educational processes as they are desired but has also improved the outcomes through alignment and to disseminate information.

On the basis of above literature, thus it can be hypothesized:

Hypothesis 1: Technology expertise is positively related to perceived quality of education.

The Leathwood and O'Connell (2003) study has shown that use of technology in the university has resulted in better outcomes in terms of student's performance, content covered and also better teaching standards. The adaptation of ICT in their education system, both teachers and students has gained the allies in accessing information, constructing relevant knowledge, and representing self and others. The greater the focus of teachers on use of computer in their system,

has resulted in greater the outputs. Student's perception about the new teaching concepts of ICTs has shown positive attitude and also has supported different approaches towards technology based learning such as, computer assisted learning, web-learning, computer-classes, online training, distance education, eLearning, virtual learning, digital training, etc. Computers are not only a focus of education but it is also used as a supporting tool in learning and teaching education. The basic grounds required are computer literacy and use of computer as a part of technology acceptance (Davis, 1989; Teo, 2008; Zhao et. al, 2003; Selwyn, 2007; Valasidou, 2008).

A positive attitude of teachers towards the use of computers efficiently and effectively is resulting in a promising future towards ICT use (Breen et al., 2001). Student learning is highly related to teacher's attitude which is why their willingness to embrace the technology is successful towards implementing ICTs in universities. However; universities are also focusing to introduce a tech-based education system regardless of formalities and getting into policies (Baomin, 2009). Youssef & Dahmani (2008) conducted a survey on the potential use of computers as a support of learning process in universities and found that it is a challenge for teachers and students both however fruitful results can only be achieved only if teachers are well prepared and have sound grounds to teach with tech-supported tools. For that matter, teachers need to be trained as well by different trainings. Zoubi et al., (2004), made another survey in which they reported that teachers, who used ICT more frequently, benefited students more than those teachers who used ICTs irregularly. The outcome results directly related to the use of ICT as a part of their education system.

Huang & Liaw (2005) in their study investigated a specific behavior is required from the person who should be trained on the ICT and it states that it requires a positive and stress free attitude to increase the learning of the individual. A similar disposition is offered by Leathwood and Connell (2003), discussed the significant importance of promoting a positive attitude toward computers, and indicates that if a student develops favorable attitudes, the other objectives of computer literacy become secondary. Wills (2006) and Selwyn (2007) also argued that the ICT integration into education system would be wasted in terms of time and money, if the training curricula failed to support the development of positive attitudes towards computers. It can also lead to more cheating results and different behaviors among students. According to UNESCO (2005), internally the introduction of laptops, smart phones and multimedia can result in distracting student's attention. This problem has been reported in highly disciplined institutes like military academies, where the observations tells that as instructors, one has to recognize that if one is going to use technology in the classroom, he/she must find additional ways to keep content meaningful, even if it comes down to the simple task of requesting computer monitors down during the instructional period and back up during the hands-on portion of class.

Despite huge efforts to position information and communication technology (ICT) as a central tenet of university teaching and learning, the fact remains that many university students and faculty make only limited formal academic use of computer technology, whilst this is usually attributed to a variety of operational deficits on the part of students, faculty, and universities (Selwyn; 2007).

On the basis of above literature, thus it can be hypothesized:

Hypothesis 2: Technology usage is positively related to quality education.

Newhouse (2002) revealed that the old teaching method was limited to text books only. Teachers were limited to books reference and hence the information and knowledge was delivered only from these sources. The focus was to pass on information in lectures form. Students only had limited notes, either from the text books or the information that they noted in the class rooms. Not only was this but the teaching concept in classrooms limited to chalk and blackboards. Students were either to miss out some part of lectures which was removed from blackboard due to limited area and time availability or they were supposed to catch up every point at a high speed. However these concepts were changed with technology and with every day changing technology new concepts are taking place (Baomin et al., 2009; Sife et al., 2007). Modes of teaching have been changed as well. The equipment's used earlier are no more appreciated. Projector overheads and slide projectors replaced blackboards and white boards. This has ultimately changed the time consuming process of dimming light, lifting and lowering the screen, redesigning the class arrangement etc. it also had an impact on class participation. The advanced mode of lectures available in digital format has also made its accessibility more readily available through internet It is assistance to all students who due to any reason were not available to attend the lecture as free lectures become available online and students could easily get hold of them any time (Underwood et al., 2006; Arning, and Ziefle, 2008).

The new technologies are introduced in such a way where a student thinks more automatically rather than critically. Therefore students tend to depend more on self-learning from readily available data on net rather than interdependency and hence leaning is made possible in more ways rather than the existing patterns. In some cases, profits are generated from universities by offering such equipment. This in other words means sometimes it is not about giving an

opportunity to teachers to make the best out of these but the purpose is to present a promising modernism (Tolani-Brown et al., 2008; Teo, 2008; Sife et al., 2007)

Valasidou (2008) results revealed that different group of students with different background showed their level of interest in ICT concept. Students with political and social sciences were more inclined towards it. Similarly male students showed a more positive attitude than female students (Li & Kirkup; 2007). As per the research, ale students have more access of computers outside the campus then female students and it was also found that male students had more interest in accessing computer than female. It was also found that students using computers at home were more progressive and with scores than those who do not use it at home.

Mobile learning which is also known as m-learning had paved a new way for the learning of individuals in the digital world. With the help of laptops, wireless devise and most commonly cell phones like personal digital assistants (PDA), computers, wireless pagers, cell phones which support internet and many other innovative contributions are in practice. Such devices had given a huge potential for learning and had saved a huge cost and time. With the help of this technology the access to the learning databases had been easy, Petrova and Sutedjo (2004), found that the pace of the digital world had made the possibility of integrating short text messaging into learning and knowledge development and it had also made students aware of the need of just in time learning for different scenarios in the academic life. The use and frequency of the usage of such devices may differ from student to student and field as well. for example, an exam revision scenario seems to suit well business while the relatively high level of 'decision makers' in the science students group indicates at the need to develop a more sophisticated interactive

mLearning scenario.

Therefore the idea is to engage students in computer learning process in such a way that such gaming can help them in learning the basics of computers. It is the responsibility of the educators to design and implement such programs that attracts the learners according to their interests, keeping the learning concept in mind. The productive outcome for integrating the technology is possible if the ICT policies are readily made and focuses on professional developments. When it comes to global level, nearly all countries are implementing ICT policies. Developed countries are implementing to a large extent and developing countries to some extent (UNESCO, 2005; Sife et al 2007, Underwood et al., 2006).

The concept of e-learning is increasing drastically. Internet access and connectivity is required on large basis in order to support this program Incentives are offered for such activities such as training the teachers, headmasters, administrators, and educators both that belong to pre-service and in-service. The teachers training of delivery is not limited to computers but efforts are made to make them online as well through e-leaning. Different trainings are designed in order to polish the teacher's skills in several activities in professional and participative manner. The basic idea for such training is to strengthen effective practices of ICT in system. Some countries like South Africa, Singapore and South Korea are far ahead in terms of monitoring, development, evaluation, which certainly indicates the impact of ICT in education (Vannatta & Beyerbach, 2000; Teo, 2008; Naidu et al., 2002). In advanced countries like Australia, ICT is fully integrated with various subjects related to primary education, whereas at secondary school, it is taught as an individual subject. For such matters, teachers are provided with a notebook.

Governments of such countries are also supportive to ICT policies as they allocate budget in order to incorporate ICT in education system. All the classrooms are completely equipped and most of them are with the multimedia. ICT has been incorporated within the curriculum as it is aimed to enhance the thinking skills, teachers who are trained get a teacher ICT literacy certification. In some developing countries like India, Philippines, Malaysia etc, there is a need of establishing goals followed by ICT policies and objectives to introduce ICT concept in universities (Newhouse, 2002; UNESCO, 2005). Further teachers proper trainings are also required. If all these aspects are implemented, it will help these countries in long run in terms of better economic development, education system and the IT sector and its better understanding. Although IT penetration is growing but still it is not up to required level globally, especially in developing countries (Tinio, 2003; Tolani-Brown, et al., 2008; Sife et al., 2007). Petrova & Sutedjo (2004), study based on the worldwide university students having an access to mobile phones. Is focused on the integration of SMS-based mobile learning into a flexible learning model and add the features of just-in-time learning? The results of their study showed that students perceive the new learning technology as useful and suitable and are ready to adopt it. Canvas et al., (2009) research indicated that teachers do have positive attitudes toward ICT integration in teaching methodology, although their attitudes toward ICT did not differ regarding gender, but did differ regarding age, computer owned at home along with computer experience.

On the basis of above literature, thus it can be hypothesized:

Hypothesis 3: Attitude toward technology is positively related to quality education.

CHAPTER 3

RESEARCH METHODOLOGY

3.1. Sample and Data Collection

This study aimed at investigating and evaluating the nature of technology integration by students and teachers across IIUI, FAST, NUST and BAHRIA universities located in Islamabad. This chapter focuses on research methodology and presents the research design and data analysis procedures. The target population in this study was teaching and students from different disciplines of study. These were people involved in one way or another in using technology for different functions at the university. A cover letter was attached explaining the purpose of the study.

3.2. Design of the Study

Research design includes the methods that were used to collect data and the rationale for choosing the population, sample, and instruments. Data analysis includes procedures that were used to make meanings that enabled the interpretations with respect to the research questions. The methodology was designed to collect data to answer the following questions:

1. How much knowledge and skills do the stakeholders have about technology and technology use?
2. Is technology deployment enhancing its use by the students and the teacher?
3. Has technology integration brought up positive attitude towards its utilization?

This study was cross-sectional as data was collected over a period of full length semester (i.e.16 weeks). Participation in the study was on voluntary basis and a cover letter ensuring strict confidentiality of the data by explaining scope and purpose of the study was provided to the respondents. Total of 400 questionnaires were distributed in faculties offering technology and computer related programs, out of which 100 from teachers and 300 from students enrolled in BBA, MBA and MS/PhD (IT, TELECOM, Computer Sciences & Electrical Engineering) technology programs were retrieved which were adequate to successfully analyze the proposed relationships.

The sample included respondents, ranging from the teaching instructors or facilitators who were directly involved in the use of technology in teaching and the students, who were involved in the research because they were regarded as the ultimate beneficiaries of technology integration. Educational qualifications ranged from bachelors to doctorate degree or equivalent. 75% were male and 25% were female. Most items other than demographics were captured using a five point likert scale with responses ranging from strongly agree=1 to strongly disagree = 5.

Non probability convenience sampling was applied in this field study with analytical tools such as multi-regressions and correlation to test the hypotheses in order to analyze the data, Statistical Package for Social Sciences (SPSS) versions 17.0 for Windows.

From the perspective of the researcher, the selected universities had a high probability that a rich mix of the respondent, programs, and institutions of higher learning are present in Islamabad. Concerning entrée, the researcher is postgraduate alum of International Islamic University, Islamabad. This suggested that the researcher was likely to be granted permission to conduct the

study in a manner explained above. Prior to starting the study, the researcher determined whether entree facilitated by coordinating with the administration. This provided the researcher with a license to interview the sampled students, instructors, and administrators.

3.3. Measures

All measures were adopted from self-reported questionnaires, because self-reporting is considered appropriate for measuring these variables. The instrument was designed with the support of literature and an extensive review was carried out. The scales used in the study for the data collection were guided with the theoretical base of literature. The scale was designed on five point likert scale and the options ranged from strongly agree to strongly disagree. The instrument used was a three-page questionnaire with four sections, based on existing questionnaires and adapted specifically for this study. The four sections based, two separate questioners; one for teachers and other for student questionnaire is presented in Appendix A.

3.3.1. Demographic characteristics.

The demographic section of the questionnaire covered gender, age, grade level, program type and experience.

3.3.2. Technology Integrated Expertise/Skills

Arning and Ziefle (2008) questionnaire items were taken particularly appropriate for the computer knowledge level of respondent and measures computer expertise sufficiently to measure technology skills.

3.3.3. Technology Usage

Simsek (2008) questionnaire items were used to assess the technology use by the respondents in learning and teaching activities to measure technology usage.

3.3.4. Attitude towards Technology

Levine and Schmid (1998) questionnaire items were drawn to assess the intentions of individuals to accept and use technology to measure technology attitude.

3.3.5. Perceived Quality Education

Simsek (2008) questionnaire items were taken to measure perception of Information and Communication Technology use on quality of education.

3.4. Theoretical Framework

The conceptual framework in this study is defined as the body of ideas that are viewed to be more ideal in explaining the process of technology integration and its' impact that is viewed as more effective in a given environment. These ideas are drawn from a body of literature from different scholars based on their research. This is the nature of qualitative evaluation research. The purpose is to evaluate a process in an educational program, that is, the process of technology integration at an institution of higher learning. The purpose is to evaluate a process in an educational program, that is, the process of technology integration at an institution of higher learning. The variables extracted for this research was after reviewing literature between the years 1989 to 2011.

3.4.1. Independent Variable

Technology integrated expertise/skills, technology use and attitude towards technology tools were taken as independent variables.

3.4.2. Dependent Variable

Impact of ICT on quality education was taken as dependent variable for this study.

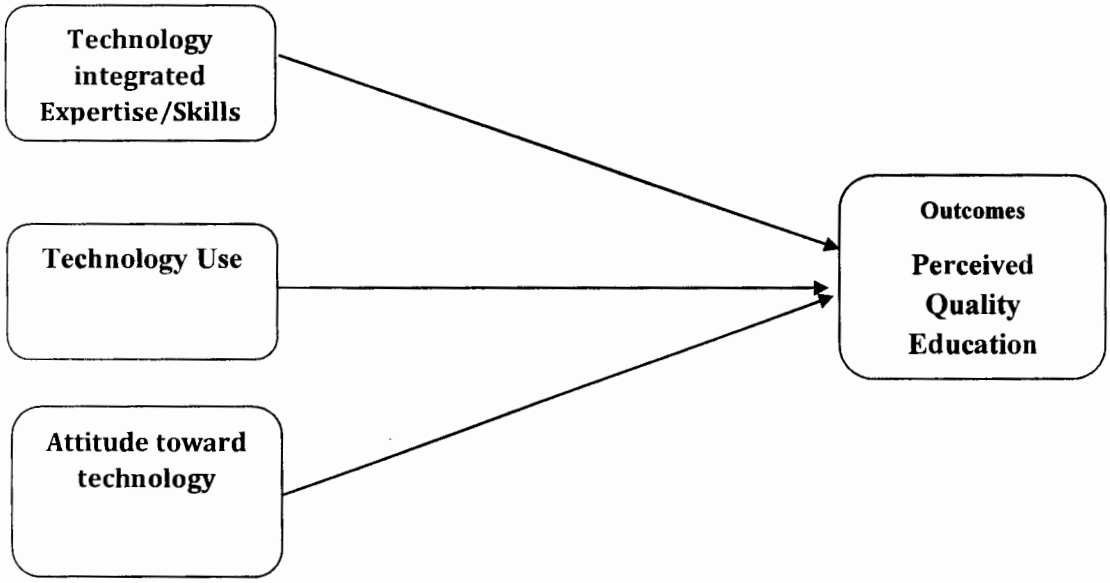

Figure 1: Conceptual Model of ICT impact on quality of education

Regression Model -1

Perception of Quality among teachers = $x + B_{1\,(\text{Teachers skills})} + B_{2\,(\text{Teachers usage})} + B_{3(\text{Teachers attitude})}$

Regression Model -2

Perception of Quality among students = $x + B_{1\ (\text{Student skills})} + B_{2\ (\text{Student usage})} + B_{3(\text{Student attitude})}$

3.5. Procedure

3.5.1. Sampling Technique

Field data was collected from four (two private and two public) universities located in Islamabad through concise administration of a survey. Convenient sampling technique was adopted because of constraints of resources and time duration.

3.5.2. Data Analysis Tools

Data was coded and analyzed using the SPSS software (version 17). At preliminary level, the means of the items were calculated for all independent and dependent variables. Descriptive statistics were obtained from sample descriptive and frequencies were run with mean and standard deviations. The normality of the data was checked by applying normality tests with Q-Q plots, which depicted that nearly all the responses were normally plotted showing normality in the data. At the next step reliability analysis was conducted for each scale of variable of interest. All the factors had cornbach alpha for teacher's questionnaire was 0.73 and for student's 0.85 respectively.

Bivariate correlation was carried out to find inter correlation among variables. As it is the case of measure of associations having multiple dependent variables, therefore multiple regression analysis technique was used to test the relationship between variables.

3.6. Hypotheses

The study tested the following hypotheses.

Hypothesis 1: Technology skill is correlated to perceived quality of education.

Hypothesis 2: Technology use is correlated to perceived quality of education.

Hypothesis 3: Attitude toward technology is correlated to perceived quality of education.

CHAPTER 4

RESULTS

This chapter presents the findings of data collected from the field. A total number of 400 respondents were involved in the study. This number included 300 students, 100 faculty members both permanent and visiting of Computer Science, Telecom Engineering, Information Technology and Business Administration department/faculty. All the subjects came from the four main universities (i.e. IIUI, NUST, FAST and BAHRIA) situated in Islamabad offering Information Technology, Computer Sciences and Telecommunications program/degrees. The data presented in this chapter were collected by using the following two strategies:

1. Questionnaire distributed to students (Appendix A). The subjects were selected from second till final semester student of BBA, MBA and MS-PhD leading programs taking technology related courses. The responses were provided in writing.
2. Questionnaire distributed to teachers (Appendix B). The subjects were permanent and visiting who had been teaching students from technology related discipline enrolled in BBA, MBA and MS-PhD leading programs. The responses were provided in writing.

By using these research strategies, the researcher was able to gain understanding of and to reflect on the nature of technology integration in the learning and teaching environment at the universities. This enabled the researcher to conduct a formative evaluation by using the established tests. The indicators based on descriptive analysis (Mean, Standard Deviations) and inferential statistics (Correlation and Regression) and additional Anova analysis. These findings enabled the researcher to put into perspective the technology usage in higher education and its perception for effective integration, in broader perspective, of the implementation of technology

as stipulated. This quantitative study was designed to investigate and evaluate the nature of technology perception and its impact at the university in learning and teaching methodologies. Thus, the data obtained were used to answer the main research question:

How much technology is integrated in learning and teaching; and quality education perceived by student and faculty?

In order to answer the main research question, the study addressed these sub questions:

1. What technology expertise is available to support teaching and learning and who uses it accordingly?
2. What is the skill level of stakeholders on technology and technology use at the universities?
3. What is quality perception of integrating technology do teachers and students have in learning and teaching?

4.1 Control Variables

4.1.1 Analysis of Variance (ANOVA) Test - Teachers

Organization gender, age and specialization were treated as control variables; as significant disparities were found between these demographics and dependent variables when one way ANOVA test was applied. One way Analysis of variance is a method of testing differences between more than two groups or treatments. Analysis of variance gives a single overall test of whether there are differences between groups or treatment. In other words analysis of variance (ANOVA) is a collection of statistical models, and their associated procedures, in which the observed variance in a particular variable is partitioned into components attributable to different

sources of variation. The above conception of ANOVA tells us that as we are dealing with multiple factors in perceptions thus we need to identify that whatever we are proposing to be the cause of any effect is true or not or are there any other factors as well which are leading to our dependent variable. Thus if we would be able to identify other related factors we can be in a position to control them.

Table 1a. One-way analysis of variance for all dependent variables across organization (teachers).

Dependent Variable		Sum of Squares	Df	Mean Square	F	Sig.
Teacher Skills	Between Groups	.698	3	.233	.211	.89
	Within Groups	105.983	96	1.104		
	Total	106.681	99			
Teacher Usage	Between Groups	4.708	3	1.569	2.817	.05
	Within Groups	53.486	96	.557		
	Total	58.193	99			
Teacher Attitude	Between Groups	3.106	3	1.035	1.212	.36
	Within Groups	82.019	96	.854		
	Total	85.125	99			

The above table clearly shows that organization (demographic variable) is only significantly related to teacher's usage and not with teacher's attitude and teachers' skills. Thus we have to control for organization when regressing teachers usage on perceptions of quality education because in this case organization also explains variance, which can inflate and misrepresent our results. In other words, if we want to see only the impact of teacher's usage of ICT on the perceptions of quality of education then we have to control the extra variance explained by organization in this context, to get the accurate percentage of variance explained by the independent variable on dependent variable.

Table 1b. One-way analysis of variance for all dependent variables across age (teachers).

Dependent Variable		Sum of Squares	Df	Mean Square	F	Sig.
Teacher Skills	Between Groups	.70	3	.23	.91	.89
	Within Groups	102.99	96	1.19		
	Total	108.81	99			
Teacher Usage	Between Groups	4.80	3	1.90	2.1	.05
	Within Groups	59.49	96	.79		
	Total	54.26	99			
Teacher Attitude	Between Groups	3.16	3	1.57	1.2	.36
	Within Groups	88.19	96	.86		

Dependent Variable		Sum of Squares	Df	Mean Square	F	Sig.
Teacher Skills	Between Groups	.70	3	.23	.91	.89
	Within Groups	102.99	96	1.19		
	Total	108.81	99			
Teacher Usage	Between Groups	4.80	3	1.90	2.1	.05
	Within Groups	59.49	96	.79		
	Total	54.26	99			
Teacher Attitude	Between Groups	3.16	3	1.57	1.2	.36
	Within Groups	88.19	96	.86		
	Total	82.25	99			

The above table clearly shows that age (demographic variable) is only significantly related to teacher's usage and not with teacher's attitude and teachers' skills. Thus we have to control for age when regressing teachers usage on perceptions of quality education because in this case age of the instructor also explains variance, which can inflate and misrepresent our results.

In other words, if we want to see only the impact of teacher's usage of ICT on the perceptions of quality of education then we have to control the extra variance explained by age in this context, to get the accurate percentage of variance explained by the independent variable on dependent variable.

Table 1c. One-way analysis of variance for all dependent variables across gender (teacher).

Dependent Variable		Sum of Squares	Df	Mean Square	F	Sig.
Teacher Skills	Between Groups	3.331	1	3.331	3.895	.041
	Within Groups	254.852	298	.855		
	Total	258.183	299			
Teacher Usage	Between Groups	4.009	1	4.009	5.584	.02
	Within Groups	213.943	298	.718		
	Total	217.951	299			
Teacher Attitude	Between Groups	.218	1	.218	.306	.60
	Within Groups	211.856	298	.711		
	Total	212.074	299			

The above table clearly shows that gender (demographic variable) is significantly related to teacher's skills and usage only and not with the teacher's attitude. Thus we have to control for age when regressing teacher's skills and usage on perceptions of quality education because in this case gender of the instructor also explains variance, which can inflate and misrepresent our results. In other words, if we want to see only the impact of teacher's skills and usage of ICT on the perceptions of quality of education then we have to control the extra variance explained by gender in this context, to get the accurate percentage of variance explained by the independent variable on dependent variable.

Table 1d. One-way analysis of variance for all dependent variables across specialization (teacher).

Dependent Variable		Sum of Squares	Df	Mean Square	F	Sig.
Teacher Skills	Between Groups	6.460	5	1.292	1.509	.19
	Within Groups	251.723	294	.856		
	Total	258.183	299			
Teacher Usage	Between Groups	10.970	5	2.194	3.116	.00
	Within Groups	206.981	294	.704		
	Total	217.951	299			
Teacher Attitude	Between Groups	6.153	5	1.231	1.757	.22
	Within Groups	205.922	294	.700		
	Total	212.074	299			

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The above table clearly shows that specialization (demographic variable) is only significantly related to teacher's usage and not with the teacher's attitude and skills. Thus we have to control for specialization when regressing teacher's usage on perceptions of quality education because in this case specialization of the instructor also explains variance, which can inflate and misrepresent our results. In other words, if we want to see only the impact of teacher's usage of ICT on the perceptions of quality of education then we have to control the extra variance

explained by specialization in this context, to get the accurate percentage of variance explained by the independent variable on dependent variable.

4.1.2 Analysis of Variance (ANOVA) Test - Students

Organization was treated as control variable; as significant disparities were found between organization (demographic) and dependent variables (which are) when one way ANOVA test was applied. Organization was directly controlled during the analysis.

Table 2a. One-way analysis of variance for all dependent variables across organization (students).

Dependent Variable		Sum of Squares	Df	Mean Square	F	Sig.
Students Skills	Between Groups	.698	3	.233	.211	.889
	Within Groups	105.983	96	1.104		
	Total	106.681	99			
Students Usage	Between Groups	4.708	3	1.569	2.817	.043
	Within Groups	53.486	96	.557		
	Total	58.193	99			
Students Attitude	Between Groups	3.106	3	1.035	1.212	.310
	Within Groups	82.019	96	.854		
	Total	85.125	99			

The above table clearly shows that organization (demographic variable) is only significantly related to student's usage and not with student's attitude and skills. Thus we have to control for specialization when regressing student's usage on perceptions of quality education because in this case specialization of the students also explains variance, which can inflate and misrepresent our results. In other words, if we want to see only the impact of student's usage of ICT on the perceptions of quality of education then we have to control the extra variance explained by organization in this context, to get the accurate percentage of variance explained by the independent variable on dependent variable.

Table 2b. One-way analysis of variance for all dependent variables across age (students).

Dependent Variable		Sum of Squares	Df	Mean Square	F	Sig.
Student Skills	Between Groups	26.405	8	3.301	4.144	.000
	Within Groups	231.778	291	.796		
	Total	258.183	299			
Student Usage	Between Groups	7.612	8	.951	1.316	.235
	Within Groups	210.340	291	.723		
	Total	217.951	299			
Student Attitude	Between Groups	14.451	8	1.806	2.660	.008
	Within Groups	197.623	291	.679		
	Total	212.074	299			

The above table clearly shows that age (demographic variable) is only significantly related to student's skills and attitude and not with the student's usage. Thus we have to control for age when regressing student's skills and attitude on perceptions of quality education because in this case age of the students also explains variance, which can inflate and misrepresent our results. In other words, if we want to see only the impact of student's skills and attitude of ICT on the perceptions of quality of education then we have to control the extra variance explained by age in this context, to get the accurate percentage of variance explained by the independent variable on dependent variable.

Table 2c. One-way analysis of variance for all dependent variables across degree program (students).

Dependent Variable		**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
Student Skills	Between Groups	6.460	5	1.292	1.509	.187
	Within Groups	251.723	294	.856		
	Total	258.183	299			
Student Usage	Between Groups	10.970	5	2.194	3.116	.009**
	Within Groups	206.981	294	.704		
	Total	217.951	299			
Student Attitude	Between Groups	6.153	5	1.231	1.757	.122
	Within Groups	205.922	294	.700		
	Total	212.074	299			

The above table clearly shows that degree program (demographic variable) is only significantly related to student's usage and not with the student's attitude and skills. Thus we have to control for degree program when regressing student's usage on perceptions of quality education. Because in this case degree program of the students also explains variance, which can inflate and misrepresent our results. In other words, if we want to see only the impact of student's usage of ICT on the perceptions of quality of education then we have to control the extra variance explained by degree program in this context, to get the accurate percentage of variance explained by the independent variable on dependent variable.

Table 2d. One-way analysis of variance for all dependent variables across gender (students).

Dependent Variable		Sum of Squares	Df	Mean Square	F	Sig.
Student Skills	Between Groups	3.331	1	3.331	3.895	.049
	Within Groups	254.852	298	.855		
	Total	258.183	299			
Student Usage	Between Groups	4.009	1	4.009	5.584	.019
	Within Groups	213.943	298	.718		
	Total	217.951	299			
Student Attitude	Between Groups	.218	1	.218	.306	.580
	Within Groups	211.856	298	.711		
	Total	212.074	299			

The above table clearly shows that gender (demographic variable) is only significantly related to student's skills and usage and not with the student's attitude. Thus we have to control for gender

when regressing student's skills and usage on perceptions of quality education because in this case gender of the students also explains variance, which can inflate and misrepresent our results. In other words, if we want to see only the impact of student's skills and usage of ICT on the perceptions of quality of education then we have to control the extra variance explained by gender in this context, to get the accurate percentage of variance explained by the independent variable on dependent variable.

Table 2e. One-way analysis of variance for all dependent variables across specialization (students).

Dependent Variable		Sum of Squares	Df	Mean Square	F	Sig.
Student Skills	Between Groups	6.460	5	1.292	1.509	.187
	Within Groups	251.723	294	.856		
	Total	258.183	299			
Student Usage	Between Groups	10.970	5	2.194	3.116	.009***
	Within Groups	206.981	294	.704		
	Total	217.951	299			
Student Attitude	Between Groups	6.153	5	1.231	1.757	.122
	Within Groups	205.922	294	.700		
	Total	212.074	299			

The above table clearly shows that specialization (demographic variable) is only significantly related to student's usage and not with the student's attitude and skills. Thus we have to control for specialization when regressing student's usage on perceptions of quality education because in this case specialization of the students also explains variance, which can inflate and misrepresent our results. In other words, if we want to see only the impact of student's usage of ICT on the perceptions of quality of education then we have to control the extra variance explained by specialization in this context, to get the accurate percentage of variance explained by the independent variable on dependent variable.

4.2. Descriptive Statistics (Teachers)

The descriptive statistics is used to calculate the statistical behavior of the variables as following;

Table 3a. Means and Standard Deviations for the main variables by teachers

	Specialization	*Teacher skills*	*Teacher Usage*	*Teacher Attitude*	*Teacher Quality Perception*
Mean	2.8	3.11	3.01	2.73	3.98
SD	1.38	0.87	0.75	0.91	0.89

All the analyses were run individually on teacher's data set in order to judge the variation in the perceptions of quality among teachers. Normality plots were used to assess frequency distributions for all constructs. The examinations demonstrated normal distributions for all the variable of interest; there are no or very few outliers (insignificant). Table 3a shows the descriptive statistics (means and SD), reliabilities and the correlation for teacher's data set. The means for teacher skills 3.11 (SD = .87), teacher usage 3.01 (SD = .75), teacher attitude 2.73 (SD= .91) and teacher perceptions of quality 3.98 (SD = .89). The mean values for these variables are more than 3 except teacher attitude. It means teachers consider all these factors

contributing towards perception of quality as their responses are more towards being agreed. With regard to teacher attitude average response is low because of their experience with the students who are less prone to technology. With respect to standard deviation (which describes the deviation from average value) all variables show higher values. It means the responses are more diverse and a lot of variability is observed in teachers regarding their attitude towards technology.

4.2. Descriptive Statistics (Students)

Table 3b. Means and Standard Deviations for the main variables by students

	Specialization	*Student skills*	*Student Usage*	*Student Attitude*	*Student Quality Perceptions*
Mean	2.8	3.2	2.98	2.92	3.08
SD	1.38	0.93	0.85	0.84	0.61

All the analyses were run individually on student's data set in order to judge the variation in the perceptions of quality among students. Normality plots were used to assess frequency distributions for all constructs. The examinations demonstrated normal distributions for all the variable of interest; there are no or very few outliers (insignificant). Table 3b shows the descriptive statistics (means and SD), reliabilities and the correlation for all variables in student data set. Correlations higher than .10 are significant at $p < .5$ (2- tailed). The means for student skills 3.20 (SD = .93), student usage 2.98 (SD = .85), student attitude 2.93 (SD= .84) and students perceptions of quality 3.08 (SD = .61). Table 2 shows the descriptive statistics (means and SD) for students' data set. The means for students skills 3.51 (SD = 1.03), students usage 2.24 (SD = .77), students attitude 3.16 (SD = .93) and students perceptions of quality 3.24 (SD = .81). The mean values for these variables are more than 3 except student usage. It means students

consider all these factors contributing towards perception of quality. Their responses are more towards being agreed. With regard to student usage average response is low because of their previous educational background of traditional way of learning, majority of students prefer technology for their entertainment rather than their educational tool. With respect to standard deviation (with describes the deviation from average value) all variables show higher values. It means the responses are more diverse and a lot of variability is observed in students regarding their attitude towards technology.

4.3 Inferential Statistics

Table 4a: Correlations for the main variables for Teachers

	Teacher Skills	Teacher Usage	Teacher Attitude	Teacher Quality Perceptions
Teacher skills	1	**(.87)**		
Teacher Usage	.49**	1	**(.84)**	
Teacher Attitude	.54**	.81**	**1**	**(.82)**
Teacher Quality Perceptions	.69**	.76**	.77**	**1 (.71)**

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

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

Note: N=100; Alpha Reliabilities are given in parentheses.

Bivariate Correlation Analysis (Teachers)

In order to check the relationship among all variables, correlation analysis is used. The bivariate correlation disclosed that teachers skills have strong positive correlation to teacher usage ($r = .49$, $p < .01$), teacher attitude ($r = .54$, $p < .01$) and teacher perceptions of quality education ($r = .69$, $p < .01$), in simple we can say that students possessing strong ICT skills are likely to use ICT tools frequently and will develop strong ICT attitude which will enhance their perceptions of quality education. While teacher usage has significant positive relationship with teacher attitude ($r = .81$, $p < .01$) and teacher perceptions of quality education ($r = .76$, $p < .01$). And also teacher attitude has significant positive correlation with teacher perceptions of quality education ($r = .77$, $p < .01$).

Bivariate Correlation Analysis (Students)

Table 4b: Correlations for the main variables for Students

	Student Skills	**Student Usage**	**Student Attitude**	**Student Quality Perceptions**
Student skills	**1**	**(.84)**		
Student Usage	.69**	**1**	**(.85)**	
Student Attitude	.44**	.71**	**1**	**(.89)**
Student Quality Perceptions	.53**	.86**	.84**	**1 (.65)**

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

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

Note: N=300; Alpha Reliabilities are given in parentheses.

The bivariate correlation disclosed that students skills have strong positive correlation to student usage ($r = .69$, $p < .01$), student attitude ($r = .44$, $p < .01$) and students perceptions of quality education ($r = .53$, $p < .01$), in simple we can say that students possessing strong ICT skills are likely to use ICT tools frequently and will develop strong ICT attitude which will enhance their perceptions of quality education.

While student usage has significant positive relationship with student attitude ($r = .71$, $p < .01$) and students perceptions of quality education ($r = .86$, $p < .01$). And also students attitude has significant positive correlation with students perceptions of quality education ($r = .84$, $p < .01$).

Regression Analysis (Teachers)

Researcher performed a number of hierarchical regression analyses to investigate teacher ICT skills, teacher ICT usage and teacher ICT attitude as forecasters of the perceptions of quality education. Regressing the perceptions of quality education on the teacher ICT skills, teacher ICT usage and teacher ICT attitude produced three regression equations. Hypotheses 1, 2 and 3 were assessed through hierarchical multiple regression analyses, entering all control variables in first step of the model (ANOVA) and independent variables in step two.

Regression Model -1

$$\textbf{Perception of Quality among teachers} = x + B_{1\,(\text{Teachers skills})} + B_{2\,(\text{Teachers usage})} + B_{3\,(\text{Teachers attitude})}$$

Teacher ICT Skills, Teacher ICT Usage, Teacher ICT Attitude and Perceptions of Quality Education

Hypothesis 1 envisaged that teacher ICT skills will be positively related to perceptions of quality education. To examine this hypothesis I applied regression on the outcome (perceptions of quality education) on teacher ICT skills, teacher ICT usage and teacher attitude. The result of direct impact of teacher ICT skills, teacher ICT usage and teacher attitude on perceptions of quality education are depicted in table 4a.

Table 5a: Regression analysis for the direct effects of teacher ICT skills on perceived quality of education

Predictors	**β**	**R^2**	**ΔR^2**
Step 1:		.04***	
Controls			
Step 2:	.68***	.34***	.30***
Teacher ICT Skills			

Note: $N = 100$; control variables are age and gender. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

The outcomes of analysis disclosed that teacher skills possess a very strong positive association with perceptions of quality education ($\beta = .68$, $p < .001$). Thus this proved H1 which states that

Hypothesis 1: Technology skill is positively related to perceived quality of education.

Further, suggesting that teacher possessing strong ICT skills are expected to have strong perceptions of quality education in their institutions.

Table 5b: Regression analysis for the direct effects of teacher ICT usage on perceived quality of education

Predictors	**β**	**R^2**	**ΔR^2**
Step 1:		.09***	
Controls			
Step 2:	.61***	.84***	.75***
Teacher ICT Usage			

Note: $N = 100$; control variables are program, gender and specialization. *$p < .05$, **$p < .01$, ***$p < .001$

Similarly, teacher usage possess a very strong positive association with perceptions of quality education ($\beta = .61$, $p < .001$). Thus this proved H2 which states that;

Hypothesis 2: Technology use is positively related to perceived quality of education.

Thus this hypothesis results suggest that teachers who frequently use ICT tools are expected to have strong perceptions of quality education in their institutions

Table 5c: Regression analysis for the direct effects of teacher ICT attitude on perceived quality of education

Predictors	β	R^2	ΔR^2
Step 1:		.03***	
Controls			
Step 2:	.89***	.64***	.61***
Teacher ICT Attitude			

Note: $N = 100$; control variable is age. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

And also, teacher attitude towards ICT possess a very strong positive association with perceptions of quality education ($\beta = .89$, $p < .001$). Thus this hypothesis results suggest that teacher who have strong attitude and acceptability towards ICT tools are expected to have strong perceptions of quality education in their institutions. Teacher ICT skills, teacher ICT tool usage and teacher ICT tool attitude explained 30%, 75% and 61% variance in perceptions of quality education respectively. Therefore every result is noteworthy and in expected way, hypotheses 1, 2 and 3 are robustly confirmed.

Regression Analysis (Students)

Researcher performed a number of hierarchical regression analyses to investigate student ICT skills, student ICT usage and student ICT attitude as forecasters of the perceptions of quality education. Regressing the perceptions of quality education on the student ICT skills, student ICT

usage and student ICT attitude produced three regression equations. Hypotheses 1, 2 and 3 were assessed through hierarchical multiple regression analyses, entering all control variables in first step of the model (ANOVA) and independent variables in step two.

Regression Model -2

Perception of Quality Among Students = $x + B_{1\ (Student\ skills)} + B_{2\ (Student\ usage)} + B_{3(Student\ attitude)}$

Student ICT Skills, Student ICT Usage, Student ICT Attitude and Perceptions of Quality Education

Hypothesis 1 envisaged that student ICT skills will be positively related to perceptions of quality education. To examine this hypothesis I applied regression on the outcome (perceptions of quality education) on student ICT skills, student ICT usage and student attitude. The result of direct impact of student ICT skills, student ICT usage and student attitude on perceptions of quality education are depicted in table 4b.

Table 6a: Regression analysis for the direct effects of student ICT skills on perceived quality education.

Predictors	**β**	**R^2**	**ΔR^2**
Step 1:		.01***	
Controls			
Step 2:	.52***	.28***	.27***
Student ICT Skills			

Note: N = 300; control variables are age and gender. *$p < .05$, **$p < .01$, ***$p < .001$

The outcomes of analysis disclosed that student skills possess a very strong positive association with perceptions of quality education ($\beta = .52$, $p < .001$). Thus this proved H1 which states that;

Hypothesis 1: Technology skill is positively related to perceived quality of education.

Thus this result suggests that students possessing strong ICT skills are expected to have strong perceptions of quality education in their institutions.

Table 6b: Regression analysis for the direct effects of student ICT usage on perceived quality education.

Predictors	**β**	**R^2**	**ΔR^2**
Step 1:		.01***	
Controls			
Step 2:	.86***	.74***	.73***
Student ICT Usage			

Note: N = 300; control variables are program, gender and specialization. *$p < .05$, **$p < .01$, ***$p < .001$

Similarly, student usage possess a very strong positive association with perceptions of quality education ($\beta = .86$, $p < .001$). Thus this proved H1 which states that;

Hypothesis 2: Technology use is positively related to perceived quality of education.

Thus this hypothesis results suggest that students who frequently use ICT tools are expected to have strong perceptions of quality education in their institutions.

Table 6c: Regression analysis for the direct effects of student ICT attitude on perceived quality education.

Predictors	**β**	**R^2**	**ΔR^2**
Step 1:		.00***	
Controls			
Step 2:	.84***	.70***	.70***
Student ICT Attitude			

Note: $N = 300$; control variable is age. $*p < .05$, $**p < .01$, $***p < .001$

And also, student attitude towards ICT possess a very strong positive association with perceptions of quality education ($\beta = .84$, $p < .001$). Thus this proved H3 which states that;

Hypothesis 3: Attitude toward technology is positively related to perceived quality of education.

Thus this hypothesis results suggest that students who have strong attitude and acceptability towards ICT tools are expected to have strong perceptions of quality education in their institutions.

Student ICT skills, student ICT tool usage and Student ICT tool attitude explained 27%, 73% and 70% variance in perceptions of quality education respectively. Therefore every result is noteworthy and in expected way, hypotheses 1, 2 and 3 are robustly confirmed.

CHAPTER 5

DISCUSSION

5.1. Major Findings

The current investigation has been very crucial in responding to various significant queries extended from literature and theoretical scaffold of this research. The findings were brought into perspective with the existing literature regarding the use of technology in education. The first research issue highlighted the relationship of ICT tools with that of perceived quality of education? This correlation result of this research reveals that the studied variables of ICT have positive association with the perception of quality education for both teachers and students.

The most important research question was: does ICT tools used, perceptions of quality education and its application be generalized and applied to Pakistan? The outcomes of this research advocates, the usage of technology tools and attitude towards technology have an impact on perception of quality of education delivered in Pakistan. The rationale is that teachers are the key implementers in the whole process of education. Ensiminger and Surry (2002) contend that faculty members represent an important group of stakeholders in this process of implementing technology at the university level. Their attitudes, involvement, and performance greatly impact how technology integration is implemented.

The findings reflect the observations by Sife, et al. (2007). In their article, they observe that the ICTs have not permeated to a great extent in many higher learning institutions in Pakistan and in many other developing countries because the socioeconomic and technological circumstances.

They observe that institutions of higher education in Pakistan still face many challenges in undertaking the ICT integration process despite achievements they have realized. They say the challenges include a lack of a systems approach to learning; awareness of and attitudes to ICTs; administrative and technical support; staff development; lack of ownership; inadequate funds; and the difficulty of transforming higher education.

5.2. Findings and Discussion

Main Effects Hypotheses

In broad-spectrum this endeavor established reasonable support for most of the predictions. Specifically Hypothesis 1 envisaged that student ICT skills will be positively related to perceptions of quality education,, the analysis disclosed that student skills possess a very strong positive association with perceptions of quality education. Thus this hypothesis results suggest that students possessing strong ICT skills are expected to have strong perceptions of quality education in their institutions. Similarly, student usage possess a very strong positive association with perceptions of quality education ($\beta = .86$, $p < .001$). Thus this hypothesis results suggest that students who frequently use ICT tools are expected to have strong perceptions of quality education in their institutions.

And also, student attitude towards ICT possess a very strong positive association with perceptions of quality education ($\beta = .84$, $p < .001$). Thus this hypothesis results suggest that students who have strong attitude and acceptability towards ICT tools are expected to have strong perceptions of quality education in their institutions. Student ICT skills, student ICT tool

usage and Student ICT tool attitude explained 27%, 73% and 70% variance in perceptions of quality education respectively. Therefore every result is noteworthy and in expected way, hypotheses 1, 2 and 3 are robustly confirmed.

5.3. Limitations

No research project is without limitations: "There is no such thing as a perfect designed study" (Marshall and Rossman, 1999).The following are the limitations of the study. These are the factors that, in one way or another, may have affected the outcome of the study.

a) The researcher had planned to travel to visit Lahore and Karachi to be in the field, but due to unavoidable circumstances she could not do that. By being in the field outside Islamabad, she felt that she would have obtained a clearer understanding of the nature of technology impact on a broader level.

a) Although this study finds full support for many hypotheses, however current study has few drawbacks and constraints which should not be ignored. The first important issue is that current research employed self-reported measures. Even though self-reported data collections procedure is suitable for current sort of study still self-reported information can lead to common method bias. Secondly, this study has a cross-sectional design. Though the outcomes of study indicate that technology adoption and usage improves the perceptions of quality education but the causality relationships could not be inferred from this study. For proving causality longitudinal study design should be incorporated.

5.4. Implications for Research

Current study crafts various inputs on hand literature of ICT and quality education. At the outset current research is one out of those research endeavors that scrutinized the ICT dimensions and their impact on education quality. Secondly, the conclusions of current study offer further support to the results of prior literature, which stated that dimensions of ICT can play important role in shaping modern education, thus enhancing its quality and standard to compete in modern technological world.

5.5. Implications for Policy Makers and Professional Development

This research has several useful implications as well. Firstly the educationist and policy makers must take into account the level of technology usage, application and skills among teachers and as well as should work to make such policies which can help and develop the faculty ICT skills and promote the usage of such skills to make their students more competitive in modern technological world. Because if policy makers will better understand these components of education environment, and problems behind acquiring and applying technology tools, they will be in better position in plummeting these issues and consequently they will be successful in managing and planning policies for faculty development. Successful technology use depends to a great extent on a supportive policy environment. Policy can help emphasize important factors, increase interactions, and create a supportive environment for technology integration. To better help teachers make use of available technology, it is very important to help teachers make connections between technology uses and their teaching tasks (to locate a technology niche) and to help teachers make creative uses of technologies (to increase technology adaptability).

5.6. Future Research Directions

The research focused on examining the use of technology and its impact on quality of education at universities in Islamabad, Pakistan. This study has implications for organizing and planning of technology. Future studies examining and assessing the nature of technology integration could look at other factors such as the planning process, the acquisition and maintenance of technology equipment, and the budget for technology integration. In terms of methods, this study used small population in the field study as one of the methods. Similar research may be done by increasing the sample size and population that would provide more concrete evidence of what the process of technology integration at the university looks like all over Pakistan.

There might be several moderators and mediators of this relationship such as level of education, type of programs, and contextual application of acquired technology skills which can better predict impact of ICT on determining quality of education. Despite the fact that education systems have been heavily investing in technology all over the world, acceptance of technology and its impact on quality education still needs to be addressed in detail in different contexts. Future research should be done to explore hypothesized conduits longitudinally, to set up causality in proposed relationships.

5.7. Conclusion

In conclusion, this study examined and assessed the use of technology imparting the quality of education as perceived by students and delivered by teachers. The findings were brought into perspective with the existing literature regarding the use of technology in education. Technology use, attitude and expertise were used to evaluate the perception of quality education with technology innovation at the university.

Success and challenges in examining the technology integration were identified. Challenges included a low level of technology skills among the students; lack of effective teacher development programs on technology; and lack of effective leadership practices regarding the use of technology in teaching and learning. This study contributed to the understanding of the nature of technology integration at four of the institutions of higher education in Islamabad, Pakistan. The researcher hopes that the knowledge gained may be used to assess and bring about changes in how technology may be beneficially for teaching and learning in higher education institutions. The study also contributed to the body of literature about technology use in education in Pakistan.

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