



## Challenges and Opportunities in the Use of ICTs in education sector of Pakistan

Nazia Nayazi<sup>1</sup>, Pakeeza Khalid<sup>2</sup>, Mudassara Perveen<sup>3\*</sup>

Institute of Agricultural Extension, Education and Rural Development, University of Agriculture Faisalabad, Pakistan

<sup>2</sup>Institute of Agricultural and Resource Economics, University of Agriculture, Faisalabad, Pakistan

<sup>3</sup>Department of computer science, Government college university of Faisalabad, Pakistan

Corresponding author: [nnazianiazi@gmail.com](mailto:nnazianiazi@gmail.com)

**Abstract:** The Pakistan government views Information and Communication Technology (ICT) as a key tool for transforming the economy, with the education sector playing an important role in developing the necessary human resources. Since from last decades, there has been a big push to introduce computers into schools, universities and integrate ICT into the education curriculum through a range of initiatives. In Pakistan, majority of the students having computer and internet facility at home. The universities had a lot of ICT facilities and infrastructure such as computer lab, Wi-Fi, computer, projection system, interactive white board, video conferencing system, audio equipment and digital photo camera. It was found that knowledge of ICT is compulsory requirement for teacher's recruitment", students have easy access to computers in university, all courses are prepared by the teachers involving ICT, there is dedicated lab. In the university and courses on technology skills are available to students and teachers. It was noted that universities have wi-fi network, broad band internet. Students needed Laptop scheme, analyze research data software is needed and to get an easy access to advanced academic material. The Ministry of Education has set a clear road map for the integration of ICT in education with the emphasis on increasing access to basic education for all, and using ICT as one of the major tools for learning, teaching, searching and information sharing. Providing colleges and universities with ICT equipment and resources, including access to the Internet is a starting point in a process of empowering young people to learn to use ICTs in a transformative way. However, we suggest that we need a more critical framework for examining issues related to the challenge of introducing ICT into universities from a social justice perspective. This is in order to "shift the focus of the digital divide discourse from questions of technological access to those of opportunities for participation and the development of cultural competencies and social skills for full involvement.

[Nazia Nayazi, Pakeeza Khalid, Mudassara Perveen. **Challenges and Opportunities in the Use of ICTs in education sector of Pakistan**. Life Sci J 2023;20(1):9-28]. ISSN 1097-8135 (print); ISSN 2372-613X (online).

<http://www.lifesciencesite.com>.02.doi:[10.7537/marslsj200123.02](https://doi.org/10.7537/marslsj200123.02).

**Key words:** ICT, education sector, opportunities

### Introduction

One of the most significant evolutions that has been experienced by the mankind is the growth in the information and communication technology in recent past which has changed the routine practices that had been practiced in different segments of our lives since long. Today is an era of technology where in all of the dimension of a humans' life have been accelerated and effected with an unprecedented rate. Today the role of scientists, mentores and gurus are somehow more than what they were years before (Awan et al., 2012), Due to the development of ICT, the limitations of distance and time have been reduced and modified in all the fields of life. Learning knowledge and getting new skills are important aspects which also have been improved by ICT. The use of ICT has affected the education sector positively by making it more competitive. This has helped in the knowledge creation

and knowledge sharing, thus, has become a focal point for the development of the long term strategies of education sector (Kozma, 2005).

ICT has made the learning experience more interactive by introducing new self-enabled teaching and learning techniques. ICT has helped both teachers and students by creating a greater interaction between both of them through emails, live lectures and other modern ways of interaction. Kozma (2005) have studied that there is a need to use ICT in a systematic way in order to ensure a brighter future for student in Pakistan's higher education system (Irons, 2007). Furthermore, according to the studies of Khan *et al.*, (2012) the use of ICT at university education should be the responsibility of the policy makers and the teachers should implement the same to help student in making the learning experience more effective and efficient.

Hawkins (2002) has suggested that it is not only the investment that is required to put in to the educational sector for the use of ICT in class room environment but also an adequate level of training is required by the teacher. Thus in order to integrate ICT at university level, a collaborated effort is required focusing an effective policy along with planning and restructuring the overall teaching process. This is the comprehensive process by fostering which the students, in smaller sceptre and the education sector, in broader spectrum can get the maximum educational benefits.

Another factor that is significant for the use of ICT is the self-efficacy of the teaching staff. It is defined as a credence that one has in one's own abilities to perform in order to achieve a goal or task (Cholin, 2005). Thus there are two dimensions of self-efficacy of the teachers regarding the use of ICT i.e. how confident a teacher is about his success in achieving the goal that is requirement of ICT and also his perception about the level of control he has over the use of ICT. Sheikh (2009) also suggested that it is not only the higher education system where the proper use and implementation of ICT is required but also the primary and secondary level as well requires a comprehensive strategy and implementation for the use of ICT for the students getting their education at this level.

Voogt (2004) makes a study suggesting that it is due to fear of a difficult learning process and also the poor attitude of teachers due to which the teacher miss their ICT training courses. Furthermore, it was also found that there is certain teacher of all primary, secondary and higher level who don't use ICT in the class room environment, even having all the required resources with them and the training skills as well because of the reluctance for adopting new methods of teaching and also the fear of making mistake for using the ICT gadgets like Multimedia, CDs, Online Class Rooms, WWW, Blog, OHP, educational Games, interactive white boards and EBooks as well. The significance of teacher training is Two folded. This type of training must aim to educate teacher by using ICT and also to enhance teachers' skill related to ICT. After providing the required skills it should be the responsibility of the Teacher to complement their content with ICT. So much so, it is the need of time that teachers should make their students learn how they can increase their knowledge by developing the modern study skills which ultimately would increase their examination and evaluation skills. The use of ICT can inspire and engage the students and this is a significant factor which effects the adaptors of ICT. With the help of ICT teachers could make lectures more interesting and attractive by using multimedia and also the students can easily capture the lectures taught to them, it helps them to memorize the lectures for longer time span. The complex processes may also make easier to understand through ICTs (Shaikh *et al.*, 2011).

ICTs integration in universities is characterized by several approaches that include computers and internet in the classrooms, integrating television and radio and computer labs, also developing structure to support learning through mobiles, using smart phones and tablets (Valk *et al.*, 2010). In some developing countries, ICT is not widely available and those institutions who have the ICTs and the computer labs have very high enrolment of students which restricted them and limiting the students to assess the ICTs in a single period which only covers the basic I.T learning that is not enough for them. In contrast the high income countries, ICT are more integrated in the educational institutions.

The ICTs have affected the education field, which undoubtedly have affected teaching, research and learning. To engage and motivate the students the ICTs can enrich their skillset, deepen skills and accelerate them. ICTs also help strengthening teaching, thus, helping university to change and create economic feasibility for tomorrow's workers. For an individual the basic education is necessary to be able to apply and assess information in a quickly changing environment. Such ability should include ICTs (Yusuf, 2005)

The non-formal education that includes literacy and health campaigns can also take benefits from the ICT (UNESCO, 2002). Higher order skills for solving complicated real world problems are also developed by the use of ICT in education (Bottino, 2003; Bhattacharya and Sharma, 2007; Lim and Hang, 2003). To prepare the workforce for the new global economy and information society ICT can be used (Kozma, 2005).

ICT's global expansion in the education sector has helped to improve the overall outcome measures of students and the quality of coaching such as it decrease the dropouts and increase the achievements (Pelgrum, 2001). ICT through transformational effect prominent to new student-cantered educational patterns empowers learning, help raise abilities of problem-solving, intellectual creativity and communication skills (Toro and Joshi, 2012).

A recent study that is based on the previous 40 years of research on the use of ICTs summarizes that ICTs used in classrooms does have positive effect on the student's achievement (Tamim *et al.*, 2011). The integration of ICT increases the reception and interaction of information and contributes to the flexibility in teaching and learning processes, the new methods giving way to improved scenarios. According to Reeves & Jonassen (1996), in the process of learning ICTs has become necessary and the learning process continues to increase as the technology influences learning.

ICTs provide many opportunities for learning through the support and provision for student cantered settings that are resource based and by enabling students to learn and practice (Barron 1998). One of the most significant contributions of ICT in field of education is easy access

to learning materials. ICT helps students to browse through e-books, past year papers, sample examination material etc. ICT also provide ease for students to access to mentors, resource persons experts, professionals and researchers (Sharma *et al.*, 2011).

For offering enhanced educational openings ICT is a powerful tool. It is impossible to imagine future educational and learning environments without the support of Information and Communication Technologies (ICT). According to Kennewell *et al.*, (2000) it is necessary to place computers in classrooms, for the purpose of maximizing opportunities. ICT environments improve students and teachers learning experience and provide better results. The development of ICT environment is made by using different kind of software, multimedia and web-based materials.

ICTs can help in developing and improving the excellence of education by giving enhance support in complex subject areas. In order to get this objective, the teachers should participate in the development of certain change strategies. It may also include teaching partnership with the ICTs as a tool. There are three conditions that the teachers must fulfil to introduce the ICT in classrooms (Zhao and Cziko, 2001). These three conditions include: (I) the teacher's believe in the technology effectiveness, (II) the teacher's believe that use of ICT will not become the cause of disturbance, and (III) the teacher's believe of having control over technology (Alexander, 1999).

Every aspect of life is increasingly pervaded by the ICTs. Because for the purpose of information processing ICTs are excellent tools. As the learning institutions are knowledge and information holding bodies therefore the ICTs should be the most important tool for management of information at all levels of educational system (Khudri and Afrin, 2017).

The use of ICT can inspire and engage the students and this is a significant feature which effects the adaptors of ICT (Khudri and Afrin, 2017). With the help of ICT teachers could make lectures more interesting and attractive by using multimedia and also the students can easily capture the lectures taught to them, it helps them to memorize the lectures for longer time span. The complex processes may also get easier to understand through ICTs, (Shaikh *et al.*, 2011).

ICTs integration in universities is characterized by several approaches that include computers and internet in the classrooms, integrating television and radio and computer labs, also developing structure to support learning through mobiles, using smart phones and tablets (Valk, *et al.*, 2010). In the developing countries the ICT is not widely available across educational institutions and some institutions that have the ICTs and the computer labs have very high enrolment of students which restricted them and limiting the students to assess the ICTs in a single period which only covers the basic

I.T learning that is not enough for them. In contrast the high income countries, ICT are more integrated in the educational institutions (Sife *et al.*, 2007).

For an individual the basic education is necessary to be able to apply and assess information in a quickly changing environment. Such ability should include ICTs.

The international aspect of educational is enhanced by ICT as well. The non-formal education that includes literacy and health campaigns can also take benefits from the ICT (UNESCO, 2002).

ICT's global expansion in the education sector has helped to improve the overall outcome measures of students and the quality of coaching such as it decrease the dropouts and increase the achievements. ICT through transformational effect prominent to new student-centered educational patterns empowers learning, help raise abilities of problem-solving, intellectual creativity and communication skills (Toro and Joshi, 2012). A recent study which is based on the previous 40 years of research on the use of ICTs summarizes that ICTs used in classrooms does have positive effect on the student's achievement (Abasov, 2011).

However, to overcome the cost issues, low quality education, less number of teachers, and to overcome the distance and time obstacles ICTs can be used as a tool. For offering educational opportunities ICT is a powerful tool. It is impossible to imagine future educational and learning environments without the support of Information and Communication Technologies (Akbaba-Altun, 2006). Every aspect of life which includes work, learning, leisure, & health is increasingly effected by the ICTs. It is because for the purpose of information processing ICTs are excellent tools (Mason, 2000).

The research conducted by Berge (1998) shows that there are four pillars on which the modern education is based i.e. learning to be, learning to know, learning to do and learning to live. The study extends the narrative by suggesting that with the help of ICT each of the given pillars can be achieved by making the overall education more effective. In order to increase the access towards the modern education, linking the education with the digital workplace thus connecting the education with the real life, the use of ICT has become inevitable now days (Parvin, 2013).

Lack of training and motivation in teaching staff for the use of ICT, financial constraint to build infrastructure and facilities need assessment among teaching community are the obstacles in the use of ICTs at the university level education (Khudri *et al.*, 2017). Teachers also do complain for the unavailability of the support from both the university administration side as well as from student for using ICT. The students also

lack in positive attitudes for the use of innovative teaching and coaching methods.

The empirical evidence suggests that in countries like Pakistan in the educational sector have not developed with the passage of time if compared with the other sector. Furthermore, in the use of ICT in educational sector has not yet been adopted along with its prerequisites as the same has been adapted in the other sectors (Khudri and Afrin, 2017). It has been empirically proven fact that the interrelation of ICT in educational sector has increased the overall standards of education at all levels by enhancing its efficiency, effectiveness and productivity.

Although the use of ICT has never yielded the desired results if it is not coupled with readiness of the institution including its teachers, student and administration; pedagogy, infrastructure building and improvement in curricula as well (Parvin, 2013). Likewise, in some cases the integration process had led to failure than success considering the cost and benefit analyses of the capital expenditure incurred to build the required infrastructure (Tondeur *et al.*, 2007).

A study done by Khan *et al.*, (2012) found that ICT integration projects get encountered by certain problems at development level. Empirical data has shown that the level of staff participation at level of policy making has remained very low. This has not only discouraged the staff for having a positive attitude for using ICT in the classrooms but has also resulted in laps in overall long term strategy as well. Furthermore, the middle level management also found to be an obstacle in the use of ICT in classroom (Ferrari *et al.*, 2009).

It is significant to reorganize, strengthen and also to utilize the prevailing educational channels in order to create a sentence and provide the possible solutions for issues being faced by students (Ozdemir and Kılıç, 2007). The increase in use of ICT has changed modes and methods of number of process which are more focused on efficient and effective learning and same is becoming the reason of redefining the level of interaction between teachers and their students (Voogt, 2004).

The present review aimed to find out role of information communication technology in classroom teaching. In countries like Pakistan, the education system does not fulfil the needs of the present era making a real threat to overall effectiveness of the educational system. Lack of finance which is required for the implementation of ICT integration along with required political will is missing over decades and has become the main reason for the productivity of the educational system is weakening. Further to this, the absence of infrastructure development including the ICT facilities, networking and compatible management information system are some other problems in development of ICTs (Hattangdi and Ghosh, 2008).

In nutshell, fostering the importance of ICT in the classroom environment, this study would examine the role of ICT in Pakistan's educational system at primary, secondary and higher level as well. Furthermore, the study would also discuss the need and demand of ICT by the teachers in order to make their classroom learning more effective and efficient for the students.

#### **Facilities and Infrastructure**

Ebijuwa (2005) gave a definition of ICT as "tools and as well as means used for assembly, capture, process, storage dissemination and transmission of information". Akinsola *et al.*, (2005) explained about the different categories of ICT. Telephones, printers, television are hardware and windows MS office are software.

Usluel *et al.*, (2008) defined ICT as use of technology to send or receive messages. To share information through ICT tools radio, television, telephone, email for receiving or sending information.

Adeyemi & Olaleye (2010) observed that the traditional process of library activities has changed by dynamic ICT, it should be the part of the world universities. Use of ICT in libraries showed that it has changed the traditional process of learning and teaching to the advanced level of learning. There is a need to start capacity building programs for library staff and library users. But applying ICT in University libraries requires a different types of ICT tools for learning. Different types of tools like television, digital technologies, computers, Internet, software application, World Wide Web & intranet, radio, telephone, email are used in different types of communication objectives.

Mondal & Bandyopadhyay (2014) explained about the use of ICT set-up in universities, use of ICT equipment's is less as compare to developed countries. The result of this gap is less flow of information to the students. ICT tools mostly used in the universities of the world are World Wide Web, the internet, E-mail services, website, and telephone.

Pulkkinen (2007) said that use of ICT tools in the universities has changed the structure of learning and teaching.

Ahmad and Fatima (2009) found that researchers apply a variation of ICT products and facilities for research and further said that ICT products help "to discover information, access information, cope, assimilate, assess, make, and communicate information more easily". It was recommended that training be pre-arranged to rise the practice of ICT-based systems and services.

Sivakumaren *et al.*, (2011) explained about the increasing use of ICT in different institutions. ICTs are growing in academic public libraries, particularly in the university atmosphere. Users' hopes have amplified due to progresses in technologies. The study recommends the resulting that the numbers of computer must increase in the universities to enable the maximum users for

getting aware of ICT services. In the university library, "Digital Library Service" is the most beneficial service. Operators can contact digital means using a number of diverse open source digital library software packages. It is found that no public library was fulfilled digitization software. It is very valuable to digitize rare groups such as older and out of print versions. Some of the ICT-assisted instructions are Radio, Internet, Television and Computer (UNESCO, 2014).

Aduwa-Ogiegbaen & Iyamu (2005) explained that students remain inactive learners while using radio and television because these are considered old and traditional technologies. Computers, however, deliver more creative and advanced teaching methods to learn easily. Academic abilities of the students are improved with the use of ICT tools. In the present time, ICT use is very helpful and creative for the students of school levels. Thinking abilities of the students are improved with the use of advanced technologies.

Balasubramanian et al., (2009) stated that use of computer is very helpful and quicker adopted ICT tool regarding the adoption ratio. Mostly students adopt and learn through computer very easily and positively. Mostly ICT tools are connected with the computer, they operate with the help or assistance of computer.

Balansk et al., (2006) said that mostly teachers at school level don't want to use ICT tools as learning and teaching aids, they want to use old and traditional methods of teaching because they don't know the proper use of ICT tools, they don't have technical skills, they lack of technical assistance that's why they prefer the old methods of teaching. Mostly students learn it from their homes like usage of mobile phones or email etc. but those students who live in rural areas don't have the facility of usage of these tools at home level that's why they learn it from teachers and can't able to complete the urban areas students. In this scenario, it is the need to provide both the same facilities to urban and rural people. So that this gape can be overcome by the state. Teacher's attitude towards the use of these tools for teaching and learning should be evaluated by the administration. More focus is needed on ICT tools because in the future most use of ICT will be encouraged and those nations which are not using innovative tools or ICT tools in teaching and learning process will face difficulty and can't able to compete those developed nations. So it is compulsory to increase the use of ICT at school level for better understanding in the universities.

#### **Needs and Demands**

Daniels (2002) described that with the passage of time ICTs have grown as one of the main and basic of the basic need of our society regarding education. Several countries now acquiring ICT and learning the basic aids and ideas of ICT as part of the basic education, along writing and reading. However, there is a delusion that ICTs usually discusses to 'computers and computing

related activities'. This is luckily not the same as assumed by many people in our society, although ICTs role is very modern and significant regarding its use. In the information management computers play a very vital role.

Pelgrum and Law (2003) stated that at the completion of 1990s, the term 'computers' was exchanged by 'IT' proposing a change of emphasis from adding skill to the ability to collection and recover facts.

Young (2002) described that one of the most vibrant assistances of ICTs in the improvement of education is easy access to education learning. With the assistance of ICTs, students and teachers can nowadays go through e-books, previous year papers, sample examination papers etc. and also have an access to source persons, tutors, specialists, scholars, authorities and seniors all over the world. This give the availability of timely book learning and delivered learning chances for numerous more beginners who before were reserved by other responsibilities.

According to New Media Consortium (2007), ICT gives a completely novel education atmosphere for students, thus demanding a different type of ability set to be effective. ICT is altering methods of learning and teaching with the addition of features of animation to learning surroundings with effective surroundings for the determination. ICT is a prevailing tool for contribution learning chances. It is tough and maybe even unmanageable to think up comings education surroundings that are not sustained, in one way or another, by ICT.

Loveless (2003) said that ICTs can improve the excellence of education in numerous methods, by adding learner inspiration and by engaging, by supporting the achievements of basic expertise, and by increasing teacher training. Transformational tools of ICT, when used suitably, can support the period to a learning environment. ICTs, particularly computers and Internet, facilitate new methods of teaching and learning rather than traditional methods and now they can do it in an improved manner. ICT has an influence on the learning environment of students not only on what they are learning but what they should the students learn in a proper learning environment.

Wheeler (2004) described that ICT delivers a motivation among students to be able to learn by a new and advanced way of learning. With the help of ICT tools like computer software, videocassettes, TV, writing, sound, and interesting affecting pictures can be used to deliver exciting flow of information that will engage them in the education process. Communicating through radio also very effective for learning as effective sounds create interest in the form of songs, comic skits which could be added for students learning and creating interest for acquiring more information by getting involved in that audio track. Some of the mothers of the

respondents speak out that their children were getting more interested than earlier in such type of education in the tutorial room rather than the fix 45 minutes talk

Valasidou and Bousiou (2005) stated that broad practice of ICTs use in education showing that it's not becoming the aid, it's becoming the basic part of education process. Through the excessive use of ICT it is becoming clear that students' academic performance can't be developed and can't be achieved the desired results without the use of ICT. Demand for ICT is becoming very high because without the use of ICT we can't get magnify access to the education. ICTs are helping to strengthen the education quality. For the betterment of these tools digital workshops should be arranged. During the last two decades, the uninterrupted relation between ICT use and students' educational performance has been the emphasis.

Shaikh (2009) highlighted the need, demand and important role of ICT in learning and teaching process. This new generation is affected by the new technology as compare to old ones. Students can take notes, can call on skype for subject related discussion with their peers and fellows, can communicate with friends through SMS and they can also read books on internet when and where they want. The other view of teachers is that the technology is creating distances between students and teachers. Most of the teachers of previous era are teaching with their old and traditional styles which is also creating distance between teachers and students. ICT is also playing its role in everyday part of life which includes online education, economic growth, engaging the community and poverty reduction.

Masood (2010) explained that education is not only for reducing poverty and making progress. It is also for the development of education and educate the society, betterment of economy and overall the progress for the countries. Many researchers said that, higher education institutes (HEIs) role is very important for the knowledge based economies which have to give skills to individuals for the betterment of society, living standard of people and through this a workforce is also produced. Tomkinson et al., (2006) highlighted that developed nations have increased the use of ICT and is also increasing in developing nations. The result in developed nations is very fruitful and a model for other nations which are currently are not using this. Higher educational institutes in the developed nations are dealing with problems such as bad governance, poverty, uncontrolled growth of population and institutional development.

Gillard et al., (2008) addressed the issue of ICT incorporation in higher education and recommend that in this dimension teachers and strategy creators can play their role for the solution of problems. Teachers can play an important part in this dimension. They can make a framework, decisions, and education policies for the

useful and careful use of ICT for the delivery of value teaching. They should also aware about the interaction of both education and ICT. Further, they recommend that secondary and tertiary education levels should be specified import when incorporating ICT in teaching and learning.

Derek & Dahlman (2006) claimed that innovative knowledge and its implementation have become central points for long-lasting improvement plans. Since ICT advances the living standard, updates cultures, upholds fair play in tutoring, improves the excellence of education and with other skills, is a strength for variation, a more expanded and flexible kind of HES in which study, education, and engagement of society.

Iqbal & Ahmed (2010) argued that this span of time demands confidence and efficacy because it used in educational and trade level for the achievement of success in learning and teaching and for the sake of job. There is a dire need in Pakistan to improve the higher education institutes and should also improve the policies related to ICT.

Isman, et al., (2010) claimed that absence of groundwork and facilities related to ICT are the main hurdles to the use of ICT in the workroom. They said that a strong ICT groundwork in higher educational institutes is an acute enabler and requirement for knowledge-driven growth.

Shaheeda et al., (2007) argued that ICT helps higher education systems in developed countries as well as developing countries also. It also improve the leaning quality and results of teaching and learning. It contributes in the progress at all levels of learning.

Binghimlas (2009) stated that beginning and extent of ICT in variable grades over the last twenty years have engaged to the arrival of information gatherings, which are from time to time known as knowledge societies. Nowadays, these societies performs an important role in the growth of information economies.

Fister et al., (2008) described that PCs are used to solve the mathematical problems and through this an innovative improvement in teaching and learning is noticed. Teachers and students getting advanced knowledge regarding innovations. Students using ICT during their learning will become a good instructor and successful educator also. They will motivate and create awareness among up comings. They will guide youth and there is a dire need to teach youth through ICT for betterment of education process.

Coates et al. (2004) presented that teaching in the universities is more fruitful and productive than the online courses which students take with heavy fee and wastage of time. These is a huge difference between formal and online education.

Fuchs and Woessman (2004) showed that link between students and ICTs accessibility proved positive and the results were significant while he took data from

International Students Association. And it was different from those who were not using ICTs as aids in learning and teaching process.

Kennewell et al. (2000) said that availability of computers in the classrooms and students should be allowed to work on them when they want. Through this a confidence will be built and they will become experts because mostly learning is fruitful by doing. ICT environment will create a friendly atmosphere for learning. Different software's and programming activities work as innovative learning for students. It has changed the learning pattern from traditional to advanced level and it has made the students able to compete with the modern time of competition.

Plomp et al (2007) stated that those teachers who have used ICT in their student life are more motivated than those who didn't use ICT in their school or student life. They also said that who use it become more motivating for themselves and for others also.

Kozma (2005) said that Different students have different perceptions regarding ICT usage. But it increases the decision power and accepting of the students at world level. It can also be said that ICT can produce a workforce for the globe and for the society for flow of information and teaching & learning process

Lim and Chai (2004) said that ICT is also beneficial for overcoming the different communication barriers like time and space which affect the communication. India is very famous in the field of IT (Information Technology) and have the population of billion –plus young people.

Amutabi and Oketch (2003) explained that trainers should be trained and well equipped with ICT tools in their formal education system. In India education is considered very important for social, political and economics. Formal system of education is considered very poor without use of ICT.

According to Zhao and Cziko (2001) introduction to ICT is very important. Teachers should be well skilled with the use of technology. For this purpose they said that for the introduction of ICT in classrooms three things are very important. First thing is that a strong believe on the effectiveness of technology by the teachers. Second thing is that there should not be any disturbance by the use of technology, everything will be going smooth and no one will disturb through this and the third thing according to these researchers is that a control is very important by the teachers on the technology there are going to use. It has been noticed that mostly teachers don't know the importance and potential of the technology. They should know the quality of the technology and it will be helpful for learning environment.

Oliver (2000) claimed that in traditional teaching content is focused as it was focused by peers and they don't concern what is the message they only know how

the message is delivered. The instructor should aware about the content and meaning what they are going to deliver. Through the use ICT, they can get help in understanding the material and meaning through tutorials and different activities for understanding curricula. ICT is helpful in finding the problem and giving a solution because it is very difficult for students to understand the content without knowing the basics of that content.

Hepp et al., (2004) narrated that computers were not common at that time but know in this era when everything related to ICT is common, it should be used at every level of teaching and learning stage for the betterment of society and for the better understanding of youth. It will be achieved by arousing interest of students then they learn it positively.

Jhurreev (2005) stated that technology has impact on learning and it has been seen that computers have a great effect on learning especially in education. At the beginning computers were used just for the programming purpose when computers were not common and after that computers become reachable in the 1970s then these were being used in schools for students. Computers and uses of tools grow into more general in the public which headed to a distress about the requirement for computer abilities in daily life.

Al-Ansari (2006) said that a lot of researches have proved the significance of ICT in learning and teaching and for the excellence results in desired fields.

Yusuf (2005) described that ICT have a great effect on learning, teaching, writing, research and understanding and landed in the education field as innovation.

Sharma (2003) explained that there are different kinds of ICT tools which are being used in education like email, audio-video conferencing, cassettes, CDs, projectors and many others which are used for different purposes.

#### **Effect of ICT**

Nisar at al., (2011) found that for the better results and efficacy of students learning ICT is very important. ICT is very helpful for the improvement of skills of students regarding the latest and innovative technology of ICT. With the use of ICT tools students can prepare their assignments easily and the presentation style will also be attractive. Students can get very productive and helpful material related to their subjects from internet. They can get assistance from video tutorials and different software. It is also helpful for preparing assignments and through projectors they can also present it in a very stylish way. It is suggested that more accessibility of tools for the learners will enhance the productivity and results of teaching and learning. Digital libraries are also very helpful and supportive for the students learning. Finally concluded that ICT has brought a positive change and impact in Pakistan.

Douglas (2011) said that visual presentations are very helpful for the education of children. Kids can get ideas of learning from visuals very easily. Education through visual aids is very productive and information communication technology has a main role in giving chances of learning and students participate willingly for learning.

Smeets (2004) stated that a learning environment is very important for the better understanding and the positivistic participation in the class activities. Different tutors apply different techniques for the communication and for learning purpose. It demands attractive environment for the learning. Trained teachers know the basic needs which are necessary for the learning environment. Sufficient ICT tools are necessary for the better understanding and ease in the use and memorizing the learning. Teachers learning is very important for better flow of information.

Braak (2002) explained that computer mediated communication is very fruitful and in the future it will only be successful if the relation between teachers and computer mediated communication becomes stronger. In the language learning programs teachers take help from the computer mediated communication and without it they are not able to learn and teach easily. For the teaching purpose computer mediated communication is productive and supportive. It also helpful for dealing different challenges.

Goodison (2002) said that awareness about the ICT is very important and the relation between school goings and ICT tools is based on the awareness regarding these tools. It should be included in the curricula for better understanding and learning. If children are taught at the lower level then they are able to perform because they got the base of ICT and they make innovations when they are at higher level.

Tondeur at al., (2006) explained that ICT skills should be included technical knowledge as well as practical skills. It should be included in teaching and learning process. In the school policy's it should be mentioned about the contents and ICT tools should be elaborated for further achievements in teaching and learning process.

Selwyn (2007) said that information communication technology is the central tent at the university level but there is still a gap between desired and current level of learning and teaching. Computer technology is not being used by the trainers as it should be used. Staff should be trained with the new and innovative things related to ICT, it will help them for gaining fruitful results.

Andersson (2006) said that learning is very important for teachers and students. If the teachers are learnt and equipped with innovative things they will be able to guide the pupils. Many teachers showed interest for getting training and many teachers said they want to learn the new things as training again. They had

knowledge but they wished to get new and innovative things. Competition among teachers also motivate them for learning new things.

Machin at al., (2007) explained the link among alterations in ICT tools and changes in teaching and learning routine in Local Education Authorities (LEAs). Previously conducted studies in economic literature showed that there is a close link between ICT and school results. This provide a balance between beneficial effects and the learning of pupils. It provide a platform for the better learning and teaching of knowledge.

Reedy (2008) said that presentations on PowerPoint and other graphic tools are commonly used in teaching and learning process. For making addictive of these applications to the students, it is mandatory for the tutors to give them practical skills and give those tasks in classrooms. It is necessary to adopt it by the students. Tutors should examine these activities while performing in the class and while using in the class for presentation. Tawalbeh (2001) said that computer literacy and awareness course has been given priority in launching by the Ministry of Education of Jordan. Directorate is able for looking after the issues which are related to the software and hardware training and maintenance courses. It is done in the supervision of schools and other learning and teaching institutes.

Tearle (2003) expressed that In UK all the staff is using ICT for making their own teaching and learning easy and understandable by the students. It helps the teachers and students also for solving the issues

Selwyn at al., (2008) stated that engaging the pupils with ICT to be often dutiful and understated, especially inside the school setting.

Meiring & Norman (2005) said that tutors should create the awareness among pupils to make their skills better and review the peers work on ICT. Special education needs can be fulfilled by the use of ICT. There is a potential in ICT to compete the all four skills in learning and teaching and to update the level of pupils for better learning.

#### **Constraints/ Problems**

According to MW (Dunya News, 2014, Jul 15), load shedding is one of the most prominent problem that students reported while using the ICT tools at home. Round about 60 % students reported this problem that they are facing this at home and university also regarding ICT use. As a whole Pakistan is facing a problem of load shedding because demand is more and production is less. It should be overcome for the better results. Due to this gap in electricity production and usage a huge gap is faced in whole country.

Qasim (2016) said that due to this shortfall of electricity ICT tools can't be used properly and the trainers and students have to face problems regarding the use of these tools.

Kiani (2016) stated that in urban areas load shedding is scheduled but in rural or backward areas load shedding is without schedule and they have to wait for unknown time and through this mostly students waste their time in the wait of electricity. This shortfall of more severe in summer as compare to winter.

According to (UNESCO, 2014) it is very dangerous for the ICT tools if they can't get stabilized electricity because without smooth flow of electricity different expensive tools may damage and the institute may face a big loss. Fluctuation is very dangerous for ICT tools. Constant supply is very important for the proper functioning of ICT tools.

Aduwa & Iyamu, (2005) praised that laptops distribution among students is very helpful and good initiative for those areas where electricity is a very big problem. Due to the shortage of electricity students face difficulty while using desktops and they lose their time while waiting the electricity, laptop distribution is very good step for smoothly use of ICT tools. At home participants face different problems while using ICT tools. After the electricity, non-availability of software is a big issue for students.

According to Salomon (2000), students face different problems other than these while using ICT tools at home. They are bad performance of tools, absence of internet, lack of technical skills, Virus attacks, slow internet and computers slow speed. These mentioned problems are those which are faced at home. There are other problems which are faced by students at university level. These are bad condition of tools, shortage of electricity, slow speed of devices, lack of fast speed internet and virus attacked computers are the difficulties which are tackled by two third of the respondents. Whereas other problems which are corrupted window, non-availability of required software, non-availability of technical support and held of computers were also reported.

Aduwa and Iyamu (2005) identified problems regarding to ICT tools usage in Nigeria. They mentioned lack of constant electricity, non-availability of relevant software, slow speed internet, improper facilities related to telecommunication, lack of technical knowledge related to computers, lack of reliable internet and non-availability of speedy computers are main problems faced by students.

Albert (2014) said that proper knowledge and skills related to software, networks, hardware, computer programming and maintenance is prerequisite for the proper usage and teaching and learning of ICT tools at university level and home level. Technical knowledge is more important because it is the basic need for proper functioning of devices. Radio, Televisions are required technical assistance for proper functioning. For proper functioning of ICT software and hardware knowledge is compulsory. For the proper delivery of information

among respondents, the agents have to prepare and know about the usage of tools and convey the information with use of these tools. Through the practice, all the hurdles and fences in the usage of technology can be handled and message can be forwarded smoothly.

Christopher (2015) analyzed that different factors impede the usage of technology in education are deficiency in basic IT skills in the training staff. They were not able to operate the ICT tools and without knowing they can't be able to deliver. They have the facilities but don't have the knowledge how to use them. Administration staff should have that knowledge so that they can supervise the learning and teaching the process and can help them in difficulties. Administration staff don't take role in solving the issues for effective ICT usage. Shortage of different tools like laptops, projectors, LCDs, printers, whiteboards and cameras is also a problem in effective integration of ICT. Staff and students want to learn but these problems act as barriers in proper functioning and learning of ICT. There should be courses for teachers to enhance the skills for better teaching. A skilled staff is required for required results in teaching and learning.

Afolake & Shittu (2005) said that there are many advantages of ICT tools in learning and teaching in mathematics but there are problems also while delivering lectures and required results are not coming due to those factors. Educators face problems in implementation of those tools due to the shortage of technical knowledge.

Keong et al., (2005) stated that Other problems mentioned by staff were less teaching time, ICT applications are complex and educators are not trained about the use of these problems, technical support is less, students don't have resources at home level and final problem is that pedagogical knowledge is not available through which students can be taught how to incorporate ICT into learning. Specified time for learning through ICT in mathematics is constraining factor because it demands more time for understanding but in class room's time is very short and limited for teaching and learning.

According to Rafiza and Maryam (2013) 55.6% of 111 respondents (educators) said that limitation of time in the universities teaching time table affect the use of ICT tools. Time required to prepare the equipment's before the teaching learning process. These limitations are strict because trainer have to wind up the lecture in specified time but these tools needs more time to understand the usage. These tools are projectors, screens, computers and other audio video aids for delivery of information. And educators don't know how to handle these tools that's they demand more time for usage.

Abramo-vich (2014) stated that if the ICT tool is broken or damaged or have any kind of disorder then they have

to call the technician then the technician take time to manage or repair that device. It takes too much time and the technician teach his own style and take time. Educators don't have the knowledge of the use of different apps in mathematics and they face difficulty. Different teachers said that they need training on specified applications for good teaching. Teaching and learning process will be more productive if the trainers will be more skilled and have technical knowledge.

Ruthven et al., (2009) explained that teaching is not easy if the trainer is not well prepared. There is a dire need to prepare the educators for teaching and they need to get courses on technical knowledge. Training should be arranged by administration for trainers with mathematics applications or related to those subjects which they are teaching. They have to become specialists in their fields of interest. Students face problems when they don't able to get their required devices like computers, internet. Damaged equipment are not able to use but they have to compromise when they have only damaged material and have to use them. Technical support is very important for teachers and students. Another factor which affect the teachers and students is the non-availability of technical support when they are at home. Mostly teachers admitted that their students face difficulty when they are at home because they don't have access to the relevant software and have problem when they need technical assistance. Those students who don't have ICT tools like computer at home, they use computers only at universities or schools then in a very short time they can't able to learn more is specified time because they don't have computers at home for practice that's why they can't learn as they should learn.

Palmer (2003) said that those teachers who don't have necessary materials or ICT tools, they are not able to learn the necessary things which are compulsory for teaching and learning in mathematics. Mostly teachers pointed out this factor as major factor for not understanding the required knowledge in ICT learning process. There are different minor factors which affect the learning process. Those factors are lack of latest computer software, use of ICT is mostly in universities not in schools and if it is used in schools then the students understand it easily in universities and difficulties in getting trainings on ICT skills.

Zakaria & Khalid (2016) briefed about the benefits of using ICT in the teaching and learning of mathematics. Use of ICT attracts students and develop interest among them for learning through ICT tools. It encourages them for learning innovative things, develop positive relationship between teachers and students. A good learning environment is necessary for the better understanding of subjects. But there are also some constraints in the learning and teaching of mathematics for the educators by using ICT. Constraints are lack of

knowledge about ICT, lack of training and learning opportunities for educators and lack of technical skills. There should be training for teachers related to the use of ICT for teaching purposes. Skills for the use of ICT develop a positive impact on the students learning. It is also said that educators should learn new skills for learning and teaching new apps related to ICT for better understanding of new technologies which will be helpful for getting good results.

Sicilia (2005) said that teachers face difficulties while using computers when they have to teach whole class and computers are not available for whole class. Author gave reason that teachers have to book computers before the class because they need a lot of computers for whole class for a long period, if they don't book prior the class start then they have to face difficulty in getting or have to wait for their turn. Mostly teachers have not access because other staff is using those devices. Non availability of computers is mostly due to the problem in any software or hardware or any other technology related to ICT. There may be many factors for the disorder of these devices, there may be fault in software or bad quality of devices and lack of personal access for educators in the use of those devices.

Korte & Hüsing (2007) found that problems are present in different schools of Europe like infrastructure and labs are not available. Lack of constant and fast speed of internet is also a problem which was noticed by the author.

Pelgrum (2001) explored ICT problems from different countries of the world and the main four problems which were noted by the author were related to accessibility of ICT. Those problems were lack of computers, lack of related software, lack of immediate access of internet and lack of peripherals.

Toprakci (2006) found that less number of computer, slow working of internet, slow working of ICT tools, lack of study related software in schools and universities. In Turkish schools these problems were found and there is a need to fix these problems for getting desired results in the teaching and learning process.

AlAlwani (2005) found that in Saudi Arabia, lack of internet access, lack of hardware assistance are the hurdles in integration of technology. In Syrian schools, lack of computers were the main barriers in technology transfer. In the classrooms of different institutes lack of ICT tools was main problem.

Becta (2004) report stated that non availability of technical or skilled staff in the schools responsible for not regular maintenance of the ICT tools that will results in the breakdown or loss of tools and deficiency of tools will occur and at the end desired results will not be achieved. It will also discourage the teachers that they feel hesitation while using ICT tools because there will be a chance of breakdown of tools. Several studies

reported that absence of technical assistance is a barrier in teaching and learning.

Gomes (2005) found that teachers need assistance while using ICT tools because they will fix any problem if something went wrong and through this gap of technical assistance will also be overcome. Lack of technical assistance in schools was considered one of the main problems for ICT use in education and it is considered a very serious issue. In Saudi Arabia, teachers agree to use ICT in science subjects but they demand for technical assistance for the solution of problems related to hardware. Teachers have a lot of experience of teaching but they don't have the experience of technical issues of ICT because they are expert in their subjects and they need assistance while using these latest and innovative teaching and learning tools.

According to Sicilia (2005), the main problem faced by the tutors was the less time for planning and preparing those lessons which are related to ICT. For this purpose they have to explore internet, and other literature because it is new for them. They don't have extra time for preparing these lectures. Educational software needs to be prepared very well before delivering a lecture. They have to get preparation for the software which is used for analysis of data. Use of ICT tools requires more time for learning. In classroom students spent less time in practicing of these tools and they need more time for learning but in the specified time it is difficult for them to learn easily or to learn quickly.

Albirini (2006) said that barriers in ICT use are different from country to country and these barriers need different planning for their solution. In developing countries, there is no competition among teachers regarding the use of ICT tools while in the developed countries teachers have competition in the use of ICT tools. This competition encourages them to get prepared for advanced learning and they practice new things at home level. No doubt, ICT skills are most important for the better learning but teachers can learn it by their own interest. Those teachers who don't have interest in using ICT at classrooms they are not able to get desired results regarding ICT usage.

Walmiki and Krishnegowda (2009) said that Information Communication Technology (ICTs) is a basic need in every field of life in modern era. ICT's role in education is frequent and necessary. It's a broad term that contains all the technologies/innovations through which information is transferred or communicated. Basically ICTs are used to enhance the improvement level in teaching learning process and student's involvement in ICTs based learning process.

Kwakman. (2003) emphasized that different features affect the effective use of ICTs tools and its usage in higher education. Different public and private institutions are achieving their momentous success in distance education learning in Pakistan. Conventional

method in education at higher level was using only course contents, textbooks, tutorials and different traditional methods of evaluation. The purpose of this study was to examine how ICTs can improve the growth of education at university level, to explore the student's use in educational based and social activities at higher educational institutions, to elaborate use of ICTs tool in literacy and management of educational institutions in developing countries.

Shaikh (2011) said that ICT's role in advanced schooling is to improve the educational services regarding medium of instruction, easy for understanding for students. But the main problem which is mostly faced is the time shortage for learning. ICT tools need more time to understand by the students but in our traditional system teachers have specific time for delivery of lecture and they have to cover the lecture in that time. ICT tools need practice for understanding but practice needs time. Ghavifekr & Athirah (2015) described that through ICT, students have both chances of education and gain information. Information through different apps and education through different tools. ICT is also very helpful in the dissemination of innovative knowledge.

Capper (2001) described that there is a need to educate the students and teachers also. Teachers can be educated about software and hardware in different sequential trainings for getting desired results. With the use of ICT students can think innovative ideas and apply them in the modern age for competing the world. Most of the teachers of previous era are teaching with their old and traditional styles which is also creating distance between teachers and students. ICT is also playing its role in everyday part of life which includes online education, economic growth, engaging the community and poverty reduction.

According to Washington DC. (2000), ICT facilitates the students to learn where and what they want. In the past traditional system was used for education. There is specific time and place for learning but now these days with the use of ICT students can learn in all our the world with no fixed time and they can use the information where they want. It is cost effective and time saving and students don't have to follow the rigid time table for online courses and they can learn through different tutorials also. They can learn anytime by just logging in to their accounts in online learning.

Kiboss & Ogunniyi, (2003) said that ICT is also used for the learning of basic education. Mostly students don't have the basic concepts about any topic. Through video tutorials students can learn by watching videos and can practice for making their skills better. This fast increase in the use of ICT tools is showing that it will become a very useful in the future and be able to get innovative results also. Digital libraries are also very helpful and supportive for the students learning. Finally concluded

that ICT has brought a positive change and impact in Pakistan and its effective use in educational institutions.

Binghimlas (2009) highlighted the importance of ICT can't be ignored because it is the future of new generation and it is currently educating the present and future of students. Government should invest on it to secure the future of new generations. All over the world ICT is working for the advances in education and education approaches for the ease of students. In the past, it was difficult to understand the terminologies used in the literature but now it is very easy to get solution of any problem related to education. Different tutorials are available to understand the difficult equations of statistics or mathematics and different equations of physics which are in a very easy language and in a very interesting learning video. Research publications are also one of the best way of disseminating the information to all over the world.

Derek & Dahlman, (2006) described that use of ICT in education is done through different methods. E-learning is also one of them, all the electronic media usage, in learning different types of media is used. Multimedia is at top position because in the education sector a lot of uses of multimedia are present. Frequent use of multimedia is in educational institutions. All the experts or teachers use multimedia in delivering the lectures. Students use it for presentations purpose. In the classrooms, it is used for teaching aid as tutors show video to the students. Science teachers use it mostly because they can elaborate and show different diagrams to the class with projector on a big screen.

Gillard et al., (2008) stated that technology is helpful for teachers to learn from different experts of the world. Teachers can take help online and through videos of international level scholars and teach the students in more advanced ways and through better teaching techniques. Scholars of developed countries use advanced methods of teaching and they make their youth more innovative and good thinker. Teachers of developing countries should take help from their experience and follow their techniques of teaching to make the youth innovative.

Patel (2018) said that expertise in innovative and advanced technologies has a great effect on the life of the learner. It has a great influence on the society, organization, institution and all over the country. Positive use of information is very important. Use of technology is increasing by the teachers and it gives fruitful results but teachers have no training for its positive use. If teachers gain skills of technical assistance for the use if these tools then they will be able to give more fruitful results.

Kong & Li (2009) claimed that the purpose of education is to reduce poverty and give manners to the societies. Education plays a vital role in maintaining and

developing the economies of the countries, development of the societies. The role of higher education institutions in the developed economies is to use the youth for the dissemination of the innovative knowledge. They invest on the individuals for learning and then they give that innovative knowledge and skills to the public. By this method they able to establish the educated society and after that an educated and developed country is formed. Dighe et al., (2009) said that ICT has developed the knowledge based economies in all over the world. These economies have led the foundation of advanced societies. These advanced and knowledge based society's needs skilled force to accelerate these ICT tools. These ICT tools have a great price that's why government help is necessary for the purchasing of these tools in bulk. Skilled and trained assistances are required for the operation of these equipment's. These tools need a very clean environment. A well-managed and learning environment is necessary for the smooth performance of these tools.

Khan & Shah (2004) stated that this time is for technology and without the use of technology survival is difficult. Advanced countries are using technology and they are gaining fruitful results by using these tools in the education and learning. Developed countries use it in education and in industry also. They use it for gaining employments, news ways of gaining desired results. With the increase in population the demand for production is increasing and without the use of technology it is impossible to fulfill the needs. So, it is necessary to use these technologies for better results and competing the world.

Ojo et al., (2007) said that world economies have become more competent with the use of ICT. These economies are able to develop the long term and effective strategies for development. This all is due to the advances in education. New methods of learning has made the countries able to develop a better strategy. Technology is a force for change because it has changed the working and results of the working. It has brought the advances in the life of individuals. Efficient societies in which socially the bond is stronger because different connecting apps, social media is very helpful for making this bond strong.

Mumcu et al., (2004) argued that ICT services and groundwork for these facilities is mandatory for the better work and fruitful results. At the government institutions these tools are not well equipped as it should be. For the development these tools should be well managed and in working condition. A brief and well planned policy should be given by the administration for the fruitful use of ICT. Teachers and technical skilled tutors can give better planning and policy for the work of these innovative tools.

Pelgrum & Law (2003) described that a solid and quality based education is only possible with the use of ICT. In

developed nations ICT tools are used at the early level. The best benefit for these tools in the early age is very fruitful as at the age of school students learn it in very interesting ways. After that when they reach at the age of universities they are experts in these tools. And they are able to teach others. They use the basics at school level and at the university level they learn advanced technologies. They can't be able to learn these advanced technologies if they have not learn it at school level. This plan should be followed by the developing countries where ICT's use is very rare and assumed to be a difficult practice and have fear of using it in teaching and learning of education.

Hussain (2008) argued that status of higher education institutions in Pakistan is going towards decline and the reasons are very common like non-technical staff is on technical posts. This type of monopoly is also in education institutes as most of the teachers who don't know the basics of ICT are using ICT and delivering lectures on ICT. They need trainings and skilled assistances but they are not getting trainings. Administration have the right to dismiss the best performer or not trained persons. All over the world, universities conduct trainings for ICT tools operation but in Pakistan it is ignored. Lack of availability of skilled teachers and non-availability of technical assistance are also the reasons for decline.

Toe (2009) said that it is difficult to accept for those teachers who never used and learned these technologies in the past or in their school or university level. But it can't be ignored, without the use of ICT it is not possible to survive in the world of competition. It is the duty of government or administration to manage these issues. There are different solutions for these problems. Trainings can be conducted with different schedules for untrained or unskilled teachers. The other option is that administration should not assign those courses to the non-technical or unskilled teachers or give them technical support during lecture which assist them in start and during the lecture. It is the need of this century to use ICT, without the use of these advanced tools youth can't compete with developed nations and they will be unaware of the use and importance of these innovations.

## References

- [1]. Abasov, S. (2011). Azerbaijan ICT Country Study. In. ADB. (2012). ICT in Education in Central and West Asia. Manila: Asian Development Bank (ADB).
- [2]. Abramovich, S. 2014. Revisiting Mathematical Problem Solving and Posing in the Digital Era : Toward Pedagogically Sound Uses of Modern Technology. International Journal of Mathematical Education in Science and Technology. 1: 1-19.
- [3]. Adeosun, O. 2010. Quality basic education development in Nigeria: Imperative for use of ICT. Journal of International Cooperation in Education. 13(2): 193-211.
- [4]. Adeyemi T. O., Olaleye F. O. 2010. Information and Communication Technology for Effective Management of Secondary Schools for Sustainable Development in Ekiti State, Nigeria, American-Eurasian Journal of scientific Research. 5 (2): 106-111.
- [5]. Aduwa-Ogiegbaen, S. E., & E. O. S., Iyamu. 2005. Using Information and Communication Technology in Secondary Schools in Nigeria: Problems and Prospects. Educational Technology & Society. 8(1): 104-112.
- [6]. Afolake, N., & Shittu, A. J. K. 2005. Evaluating the Impact of Technology Integration in Teaching and Learning. The Malaysian Online Journal of Educational Technology. 2: 23-29.
- [7]. Ahmad, N., & Fatima, N. 2009. Usage of ICT Products and Services for Research in Social Sciences at Aligarh Muslim University. DESIDOC Journal of Library and Information Technology. 29(2): 25-30.
- [8]. Ahmed, S.I. 2011. Issue of medium of instruction in Pakistan. International Journal of Social Sciences and Education, 1(1): 66-82.
- [9]. Akbaba-Altun, S., 2006. Complexity of integrating computer technologies into education in Turkey. Journal of Educational Technology & Society, 9(1).
- [10]. Akinsola O. S., Herselman M. E., Jacobs S. J. 2005. ICT Provision to Disadvantage Urban Communities: A Study in South Africa and Nigeria. International Journal of Education and Development using Information and Communication Technology (IJEDICT). 1(3): 19-41.
- [11]. AlAlwani, A. 2005. Barriers to Integrating Information Technology in Saudi Arabia Education. Doctoral Dissertation, the University of Kansas, Kansas.
- [12]. Al-Ansari, H. 2006. Internet use by the faculty members of Kuwait University. The Electronic Library. 24(6): 791-803.
- [13]. Albert, C. O. 2014. Constraints to Effective Use of ICT among Extension Professionals and Farmers in Extension Delivery in Rivers State, Nigeria. Singaporean Journal of Business Economics and Management Studies. 2 (11): 136-142.
- [14]. Albirini, A. 2006. Teachers' attitudes toward information and communication technologies:

- The case of Syrian EFL teachers. *Computers & Education* 47: 373-398.
- [15]. Alexander, J.O., 1999. Collaborative design, constructivist learning, information technology immersion, & electronic communities: a case study. *Interpersonal Computing and Technology Journal*, 7(1), pp.1-28.
- [16]. Amutabi, M. N. & Oketch, M. O. 2003. Experimenting in Distance Education: The African Virtual University (AVU) and the Paradox of the World Bank in Kenya', *International Journal of Educational Development*. 23(1): 57-73.
- [17]. Andersson Sven, B., 2006. Newly Qualified Teachers Learning Related to their Use of Information and Communication Technology: A Swedish Perspective. *British Journal of Educational Technology*. 37(5): 665-682.
- [18]. Awan, I. A., Qureshi, M. J., & Ahmad, W. 2012. An Analytical Approach in Education for Teacher Development Using Information and Communication Technologies.
- [19]. Ayub, A. F. M., Hamid, W. H. W., & Nawawi, M. H. 2014. Use of Internet for Academic Purposes among Students in Malaysian Institutions of Higher Education. *The Turkish Online Journal of Educational Technology*. 13(1): 232-241.
- [20]. Balanskat, A., Blamire, R., & Kefala, S. 2006. A review of studies of ICT impact on schools in Europe: European School net.
- [21]. Balasubramanian, K., Clarke-Okah, W., Daniel, J., Ferreira, F., Kanwar, A., Kwan, A., West, P. 2009. ICTs for Higher Education. Background paper from the Commonwealth of Learning UNESCO World Conference on Higher Education. UNESCO World Conference on Higher Education Paris, 5 to 8 July 2009.
- [22]. Barron, A. (1998). Designing Web-based training. *British Journal of Educational Technology*, Vol. 29, No. (4), Pp; 355-371
- [23]. Becta 2004. What the research says about using ICT in Geography. Coventry: Becta
- [24]. Behrstok, E., Clifford, M. 2009. Leading Gen Y Teachers: Emerging Strategies for School Leaders. TQ Research & Policy BRIEF, Washington, DC, USA.
- [25]. Berge, Z. (1998). Guiding principles in Web-based instructional design. *Education Media International*, Vol. 35No.(2), Pp;72-76.
- [26]. Berk, R. A. 2009. Teaching Strategies for the Net Generation. *Transformative Dialogues: Teaching & Learning Journal*. 3(2): 1-23.
- [27]. Bhattacharya, I. & Sharma, K. (2007), 'India in the knowledge economy – an electronic paradigm', *International Journal of Educational Management* Vol. 21 No. 6, Pp. 543-568.
- [28]. Biemer, P. (2004). Modeling measurement error to identify flawed questions. In S. Presser, J. M. Rothgeb, M. P. Couper, J. T. Lessler, E. Martin, J. Martin, & E. Singer (Eds.), *Methods for testing and evaluating survey questionnaires* pp. 225-246.
- [29]. Binghimlas, K. A. 2009. Barriers to the successful integration of ICT in teaching and learning: A Review of literature. *Euroasia Journal of Mathematics, Science and Technology Education*. 5(3): 235-245.
- [30]. Binghimlas, K. A. 2009. Barriers to the successful integration of ICT in teaching and learning: A Review of literature. *Euroasia Journal of Mathematics, Science and Technology Education*. 5 (3): 235-245.
- [31]. Bingimlas, K. A. 2009. Barriers to the successful integration of ICT in teaching and learning environments: A review of the literature. *Euroasia Journal of Mathematics, Science and Technology Education*. 5(3): 235-245.
- [32]. Bottino, R. M. (2003), 'ICT, national policies, and impact on schools and teachers' development' 'CRPIT '03: Proceedings of the 3.1 and 3.3 working groups conference on International federation for information processing', Australian Computer Society, Inc., Darlinghurst, Australia, Australia, 3-6.
- [33]. Braak J., 2002. Factors influencing the use of computer mediated communication by teachers in secondary schools; *Computers & Education*, 36: 41-57.
- [34]. Cachia, R., Ferrari, A., Ala-Mutka, K., & Punie, Y. (2010). Creative learning and innovative teaching. Final report on the study on creativity and innovation in education in the EU member states.
- [35]. Caldas, S.J. and C. Bankston. 2004. Effect of school population socioeconomic status on individual academic achievement. *The Journal of Educational Research*, 90(5): 269-277.
- [36]. Capper J. 2001. "E-learning growth and promise for the developing world", In: "TechKnowLogia".
- [37]. Chan, K., & Fang, W. 2007. Use of internet and traditional media among young people. *Young Consumers*. 8(4): 244-256.

- [38]. Cheah H., Wong P. 2007. Enabling Teaching and Learning Through The Use of ICT in Singapore Universities, National Institute of education, Nanyang Technological University, Singapore Technical paper available at: [http://www.rihed.seameo.org/mambo/uploadfiles/ict/ICT\\_Singapore.pdf](http://www.rihed.seameo.org/mambo/uploadfiles/ict/ICT_Singapore.pdf)
- [39]. Cholin, V. S. (2005), 'Study of the application of information technology for effective access to resources in Indian university libraries', *The International Information & Library Review* Vol.37, No.(3), 189-197.
- [40]. Christopher K. R. 2015. Constraints to the Integration of ICT in the Teaching-Learning Process: A Case of Tambach Teachers Training College, Keiyo-marakwet, Kenya. *International Journal of Advanced Research*. 3 (10): 34 – 88.
- [41]. Coates, D. and B. R. Humphreys. 2004. "No Significant Distance" between Face-to-face and Online Instruction: Evidence from Principles of Economics". *Economics of Education Review*. 23 (6): 533-546.
- [42]. Daniels J.S. 2002. "Foreword" in *Information and Communication Technology in Education—A Curriculum for Schools and Programme for Teacher Development*. Paris: UNESCO.
- [43]. Davis, N.E., & Tearle, P. (Eds.). (1999). *A core curriculum for telematics in teacher training*. Available: [www.ex.ac.uk/telematics.T3/corecurr/tteach98.htm](http://www.ex.ac.uk/telematics.T3/corecurr/tteach98.htm)
- [44]. De Leeuw, E., Borgers, N., & Smits, A. (2004). Pretesting questionnaires for children and adolescents. In S. Presser, J. M. Rothgeb, M. P. Couper, J. T. Lessler, E. Martin, J. Martin, & E. Singer (Eds.), *Methods for testing and evaluating survey questionnaires* pp. 409–429.
- [45]. Derek H. C. and C. J. Dahlman. 2005. *The Knowledge Economy. The KAM Methodology and World Bank Operations*. The World Bank, Washington. Retrieved August 18, 2010, from [http://siteresources.worldbank.org/KFDLP/Resources/KAM\\_Paper\\_WP.pdf](http://siteresources.worldbank.org/KFDLP/Resources/KAM_Paper_WP.pdf).
- [46]. Derek H. C. Chen, Dahlman C. J. 2005. *The Knowledge Economy, the KAM Methodology and World Bank Operations*. The World Bank, Washington. Retrieved August 18, 2010, from [http://siteresources.worldbank.org/KFDLP/Resources/KAM\\_Paper\\_WP.pdf](http://siteresources.worldbank.org/KFDLP/Resources/KAM_Paper_WP.pdf).
- [47]. Dighe, A., Hakeem, H. A., & Shaeffer, S. 2009. ICTs in non-formal education in Asia Pacific. *Digital Review of Asia Pacific* 2009–2010.
- [48]. Douglas Graeme, 2001. ICT, Education, and Visual impairment; *British journal of Educational Technology* 32(3): 353-364.
- [49]. Dunya News. 2014. Electricity shortfall reaches record level. Retrieved from <http://dunya.com/news/2014/08/22/Electricity-shortfall-reaches-record-level>
- [50]. Ebijuwu, A.A. 2005. Information and Communication Technology in university libraries: The Nigeria experience. *Journal of Library and Information Science*. 7(1&2): 23-30.
- [51]. Etebu, A.T. 2010. ICT Availability in Niger Delta University Libraries. *Library Philosophy and Practice*. Available: <http://unllib.unl.edu/LPP/etebu3.htm>
- [52]. Ferrari, A., Cachia, R., & Punie, Y. (2009). Innovation and creativity in education and training in the EU member states: Fostering creative learning and supporting innovative teaching. JRC Technical Note, 52374.
- [53]. Fister, K. R., & McCarthy, M. L. 2008. "Mathematics instruction and the tablet PC". *International Journal of Mathematical Education in Science and Technology*. 39 (3): 285-292.
- [54]. Forsyth, B., Rothgeb, J. M., & Willis, G. B. (2004). Does pretesting make a difference? an experimental test. In S. Presser, J. M. Rothgeb, M. P. Couper, J. T. Lessler, E. Martin, J. Martin, & E. Singer (Eds.), *Methods for testing and evaluating survey questionnaires* pp. 525–546.
- [55]. Fowler, F. J. (2004). The case for more split-sample experiments in developing survey instruments. In S. Presser, J. M. Rothgeb, M. P. Couper, J. T. Lessler, E. Martin, J. Martin, & E. Singer (Eds.), *Methods for testing and evaluating survey questionnaires* pp. 173–188.
- [56]. Fuchs; Woessman, I. 2004. "Computers and Student Learning: Bivariate and Multivariate Evidence on the Availability and Use of Computers at Home and at School", CESifo Working Paper. No. 1321. November. Munich.
- [57]. Ghavifekr S. & W. Athirah. 2015. Teaching and learning with technology: Effectiveness of ICT integration in schools. *International Journal of Research in Education and Science*. 1(2): 175-191.

- [58]. Ghavifekr, S., T. Kunjappan, L. Ramasamy and A. Anthony. 2010. Teaching and Learning with ICT Tools: Issues and Challenges from Teachers' Perceptions. *Malaysian Online Journal of Educational Technology*. 4(2): 38-57.
- [59]. Gillard, S., Bailey, D., & Nolan, E. 2008. Ten Reasons for IT Educators to be Early Adopters of IT Innovations. *Journal of Information Technology Education*. 7: 21-33.
- [60]. Gillard, S., Bailey, D., & Nolan, E. 2008. Ten Reasons for IT Educators to be Early Adopters of IT Innovations. *Journal of Information Technology Education*. 7: 21-33.
- [61]. Godwin, S. and R. Surtherland. 2004. Whole-class technology for learning mathematics: the case of functions and graphs. *Education, Communication and Technology*. 4(1): 131-152.
- [62]. Gomes, C. 2005. Integration of ICT in science teaching: A study performed in Azores, Portugal. *Recent Research Developments in Learning Technologies*.
- [63]. Goodison, T.A., 2002. Learning with ICT at primary level: pupils' perceptions; *Journal of Computer Assisted Learning*. 18: 282-295.
- [64]. Government of Punjab. 2011. Youth development program. Retrieved May 1, 2017 from <http://www.youth.punjab.gov.pk/freelaptops.aspx>
- [65]. Haddad, W. D., & Jurich, S. 2002. ICT for education: potential and potency. In W.D. Haddad & A. Draxler (Eds.), *Technologies for education*. Paris: UNESCO and AED.
- [66]. Hattangdi, A., & Ghosh, A. (2008). Enhancing the quality and accessibility of higher education through the use of Information and Communication Technologies. In *International Conference on Emergent Missions, Resources, and the Geographic Locus in Strategy as a part of the 11th Annual Convention of the Strategic Management Forum (SMF), India 2008 (Vol. 2011, pp. 1-14)*.
- [67]. Hawi, N. S. 2012. Internet addiction among adolescents in Lebanon. *Computers in Human Behavior*. 28: 1044-1053.
- [68]. Hawkins, R. (2002) Ten lessons for ICT and education in the developing world.
- [69]. HEC, Pakistan. 2016. PM's national laptop scheme. Retrieved May 1, 2017 from <http://hec.gov.pk/english/services/students/pmnls/Pages/default.aspx#sthash.v2ogF6ZH.dpuf>
- [70]. Hepp, K. P., Hinostroza, S.E., Laval, M.E., Rehbein, L. F. 2004 "Technology in Schools: Education, ICT and the Knowledge Society" OECD. Available: [www1.worldbank.org/education/pdf/ICT\\_report\\_oct04a.pdf](http://www1.worldbank.org/education/pdf/ICT_report_oct04a.pdf).
- [71]. Hussain, T. 2008. Dilemma of Higher Education in Pakistan and Role of World Bank. X International Summerschool In Lifelong Learning: Participatory learning, citizenship and Identity. Denmark: Roskilde University.
- [72]. Iqbal, M. J., & Ahmed, M. 2010. Enhancing Quality of Education through E-learning: The Case Study of Allama Iqbal Open University. *The Turkish Online Journal of Distance Education-TOJDE*.
- [73]. Irons, A. (2007) *Enhancing learning through formative assessment and feedback*. Routledge.
- [74]. Isman, A., Isbulan, O. 2010. Usability level of distance education website. *The Turkish Online Journal of Educational Technology*. 9(1): 243-258.
- [75]. Jhurreev, V. 2005. "Technology Integration in Education in Developing Countries: Guidelines to Policy Makers". *International Education Journal*. 6(4): 467-483.
- [76]. Jonassen, D. & Reeves, T. (1996). Learning with technology: Using computers as cognitive tools. In D. Jonassen (Ed.), *Handbook of Research Educational on Educational Communications and Technology* (pp 693-719). New York: Macmillan
- [77]. Jung, I. 2005. ICT-Pedagogy integration in teacher training: Application cases worldwide. *Educational Technology & Society*. 8 (2): 94-101.
- [78]. Kean, K., and W.D. Tsai. 2005. Parenting practices and children's education outcomes. *Economics of Education Review*, 24(1): 29-43.
- [79]. Kennewell, S., Parkinson, J., & Tanner, H. 2000. "Developing the ICT capable school". London: Routledge Falmer.
- [80]. Kennewell, S., Parkinson, J., & Tanner, H.(2000)."Developing the ICT capable school". London: Routledge Falmer.
- [81]. Keong, C., H. Sharaf, H., & Daniel, J. 2005. A Study on the Use of ICT in Mathematics Teaching. *Malaysian Online Journal of Instructional Technology (MOJIT)*. 2: 43-51.
- [82]. Khan, A. M., & Shah, Q. A. 2004. Study on Impact of Information and Communication Technology on Decent Work in Pakistan. Islamabad: Pakistan Manpower Institute,

- Ministry of Labour Manpower & Overseas Pakistanis, Government of Pakistan.
- [83]. Khan, M., Hossain, S., Hasan, M., & Clement, C. K. (2012). Barriers to the introduction of ICT into education in developing countries: The example of Bangladesh. *Online Submission*, 5(2), 61-80.
- [84]. Kiani, K. 2016. Load shedding hours for summer announced. *Dawn*. Retrieved from <https://www.dawn.com/news/1253259>
- [85]. Kiboss & Ogunniyi. 2003. Influence of a Computer-based Intervention of Students' Conceptions of Measurement in Secondary Schools Physics in Kenya *Themes in Education*. 4(2): 203-217.
- [86]. Kong, S. C. & Li, K. M. 2009. Collaboration between school and parents to foster information literacy: Learning in the information society. *Computers & Education*. 52(2): 275-282.
- [87]. Korte, W. B., & Hüsing, T. 2007. Benchmarking access and use of ICT in European schools 2006: Results from Head Teacher and A Classroom Teacher Surveys in 27 European countries. 2(1): 1-6.
- [88]. Kozma, R. 2005. 'National Policies That Connect ICT-Based Education Reform To Economic And Social Development', *Human Technology*. 1 (2): 117-156.
- [89]. Kozma, R.(2005), 'National Policies That Connect ICT-Based Education Reform To Economic And Social Development', *Human Technology Vol.1, No. (2), Pp; 117-156*.
- [90]. Lim, C. P. & Chai, C.S. (2004), An activity-theoretical approach to research of ICT integration in Singapore schools: Orienting activities and learner autonomy', *Computers & Education Vol. 43, No. (3), Pp; 215--236*.
- [91]. Lim, C. P. & Chai, C.S. 2004. An activity-theoretical approach to research of ICT Integration in Singapore schools: Orienting activities and learner autonomy', *Computers & Education*. 43(3): 215-236.
- [92]. Lin, Y. S. (2011). Fostering creativity through education—a conceptual framework of creative pedagogy. *Creative education*, 2(03), 149.
- [93]. Long, S. (2001), "Multimedia in the art curriculum: Crossing boundaries". *Journal of Art and Design Education*, Vol.20, No.(3), Pp255-263.
- [94]. Loveless, A. 2003. An evaluation of professional knowledge and pedagogy in art and ICT. *Journal of Art and Design Education*. 22 (2): 145-154.
- [95]. Machin Stephen, McNally Sandra and Olmo. Silva, 2007. New Technology in Schools. *The Economic Journal*. 3(2): 1145-1167.
- [96]. Mackenzie, N. and Knipe, S. (2006) *Research Dilemmas: Paradigms, Methods and Methodology*. *Issues in Educational Research*, 16, 193-205.
- [97]. Martin, E. (2004). Vignettes and respondent debriefing for questionnaire design and evaluation. In S. Presser, J. M. Rothgeb, M. P. Couper, J. T. Lessler, E. Martin, J. Martin, & E. Singer (Eds.), *Methods for testing and evaluating survey questionnaires* pp. 149–171.
- [98]. Mason, R. (2000), 'From distance education to online education', *The Internet and Higher Education Vol .3No.(1-2),Pp; 63-74*.
- [99]. Masood, M. 2010. An Initial Comparison of Educational Technology Courses for Training Teachers at Malaysian Universities: A Comparative Study. *The Turkish Online Journal of Educational Technology*. 9(1): 23-27.
- [100]. Mehmood, S., L. Chong and M. Hussain. 2018. Females Higher Education in Pakistan: An Analysis of Socio-Economic and Cultural Challenges. *Advances in Social Sciences Research Journal*, 5(6): 379-397.
- [101]. Meiring L. and N. Norman. 2005. How can ICT contribute to the learning of foreign Languages by Pupils. *Support for Learning*. 20(3): 129-134.
- [102]. Mondal A. K. and A. K. Bandyopadhyay. 2014. Availability of ICT Infrastructure in the University Libraries of West Bengal, India. *Journal of Library & Information Science*. 4(2): 287-295.
- [103]. Mumcu, K. F., Usluel, K. Y., & Seferoğlu, S. S. 2004. Mesleki ve teknik okul öğretmenlerinin bilgisayar kullanımları ve engeller. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, 26: 91-100.
- [104]. N., Khudri, M. M., & Afrin, S. (2017). Impact Factors of ICT on the Learning Process of Students: A Study on Private Universities in Bangladesh. *South Asian Journal of Management*, 24(1), 32.
- [105]. New Media Consortium. 2007."Horizon Report, retrieved July 1, 2007 from [www.nmc.org/pdf/2007\\_Horizon\\_Report.pdf](http://www.nmc.org/pdf/2007_Horizon_Report.pdf).
- [106]. Nisar, M. W., E. U. Munir and S. A. shad. 2011. Usage and Impact of ICT in Education Sector; A Study of Pakistan. *Aust. J. Basic & Appl. Sci*. 5(12): 578-583.

- [107]. Ojo, A., Basanya, R., Janowski, T., & Reed, M. 2007. South-South Cooperation in Software Technology. Technical Report 371, UNU-IIST, Macau, April 2007.
- [108]. Oliver, R. 2000. Creating Meaningful Contexts for Learning in Web-based Settings. Proceedings of Open Learning 2000. (Pp; 53-62).Brisbane: Learning Network, Queensland.
- [109]. Ozdemir, S., & Kılıç, E. (2007). Integrating information and communication technologies in the Turkish primary school system. *British Journal of Educational Technology*, 38(5), 907-916.
- [110]. Palmer, C. 2003. Using ICT in Mathematics Helping or Not? In R. Hudson (Ed.), *Mathematics Teaching* (pp. 9-11). Association of Teachers of Mathematics.
- [111]. Parvin, S. (2013). Integrations of ICT in education sector for the advancement of the developing country: some challenges and recommendations-Bangladesh perspective. *International Journal of Computer Science & Information Technology*, 5(4), 81.
- [112]. Patel, S. Scope of ICT in Future Education. 1-4
- [113]. Pelgrum, W. J. (2001). Obstacles to the integration of ICT in education: results from a worldwide educational assessment. *Computers & education*, 37(2), 163-178.
- [114]. Pelgrum, W. J., & Law, N. 2003. ICT in education around the world: Trends, problems and prospects. Paris: UNESCO.
- [115]. Pelgrum, W. J., Law, N. 2003. "ICT in Education around the World: Trends, Problems and Prospects" UNESCO-International Institute for Educational Planning. Available: [www.worldcatlibraries.org/wcpa/ow/02d077080fcf3210a19afeb4da09e526.html](http://www.worldcatlibraries.org/wcpa/ow/02d077080fcf3210a19afeb4da09e526.html).
- [116]. Pelgrum, W. J. 2001. Obstacles to the integration of ICT in education: results from a worldwide educational assessment. *Computers & Education*. 37: 163-178.
- [117]. Philip A., Oluwabemi O., Oluwaranti A. 2010. An Evaluation of the Impact of Information and Communication Technologies Diffusion in Nigeria's Higher Educational Institutions, *Journal of Information Technology Impact*. 10 (1): 25-34.
- [118]. Plomp, T.; Pelgrum, W. J. & Law, N. (2007), 'SITES2006—International comparative survey of pedagogical practices and ICT in education', *Education and Information Technologies*. 12(2): 83- 92.
- [119]. Pulkkinen, J., 2007. Cultural globalization and integration of ICT in education, in *Educational Technology: Opportunities and Challenges*, K.E. Kumpulainen Editor., Finland: University of Oulu. 13-23.
- [120]. Qasim, M. 2016. The dangers of Pakistan's coal revival. *Dawn*. Retrieved from <https://www.dawn.com/news/1242279>
- [121]. Rafiza, A. R., & Maryam, A. R. 2013. Pembinaan Media Pengajaran berdasarkan Multimedia di kalangan Guru ICTL. *Jurnal Kurikulum & Pengajaran Asia Pasifik*, 1, 20-31.
- [122]. Rajan, S. K. 1991. Determination of new strategies for improving wheat production in Loralai, Balochistan. M.Sc. (Hons.) Thesis, Dept. of Agri. Ext., Univ. of Agri., Faisalabad, Pakistan.
- [123]. Reedy, B. 2008. PowerPoint, interactive whiteboards, and the visual culture of technology in schools; *Technology, Pedagogy and Education*, 17(2): 143-162.
- [124]. Ruthven, K., Deaney, R., & Hennessy, S. 2009. Using Graphing Software to Teach about Algebraic Forms: A Study of Technology-Supported Practice in Secondary-School Mathematics. *Educational Studies in Mathematics*. 71: 279-297.
- [125]. Sallai Gy. 2012. The Cradle of the Cognitive Infocommunications, *Acta Polytechnica Hungarica*. 9(1): 171-181.
- [126]. Selwyn, N., 2007. The use of computer technology in university teaching and learning: a critical perspective; *Journal of Computer Assisted Learning*, 23: 83-94.
- [127]. Selwyn, N., J. Potter and S. Cranmer. 2008. Primary pupils' use of information and communication technologies at school and home. ; *British Journal of Educational Technology*.
- [128]. Shaheeda, J., Dick, N., & Laura, C. 2007. The role of ICTs in higher education in South Africa: One strategy for addressing teaching and learning challenges. *International Journal of Education and Development using Information and Communication Technology*. 3(4), 131-142.
- [129]. Shaikh, Z. A. 2009. Usage, Acceptance, Adoption, and Diffusion of Information and Communication Technologies in Higher Education: A Measurement of Critical Factors. *Journal of Information Technology Impact (JITI)*, 9(2), 63-80.

- [130]. Shaikh, Z. A. and S. A. Khoja. 2011. Role of ICT in shaping the future of Pakistani Higher Education System. *The Turkish Online Journal of Educational Technology*. 10(1): 149-161.
- [131]. Shaikh, Z. A., & Khoja, S. A. (2011). Role of ICT in shaping the future of Pakistani higher education system. *TOJET: The Turkish Online Journal of Educational Technology*, 10(1).
- [132]. Sharma, A., Gandhar, K., Sharma, S., & Seema, S. (2011). Role of ICT in the Process of Teaching and Learning. *Journal of Education and Practice*, 2(5), 1-6.
- [133]. Sharma, R. 2003. 'Barriers in Using Technology for Education in Developing Countries', IEEE0-7803-7724-9103. Singapore schools', *Computers & Education*. 41(1): 49-63.
- [134]. Sicilia, C. 2005. The Challenges and Benefits to Teachers' Practices in Constructivist Learning Environments Supported by Technology. Unpublished master's thesis, McGill University, Montreal.
- [135]. Siddiquah, A. and Salim, Z. 2017. The ICT Facilities, Skills, Usage, and the Problems Faced by the Students of Higher Education. *Journal of Mathematics Science and Technology Education*. 13(8): 4987-4994.
- [136]. Sife, A., Lwoga, E., & Sanga, C. (2007). New technologies for teaching and learning: Challenges for higher learning institutions in developing countries. *International journal of education and development using ICT*, 3(2), 57-67.
- [137]. Sivakumaren, K.S., V. Geetha and B. Jeyaprakash. 2011. ICT Facilities in University Libraries: A Study. <http://unllib.unl.edu/LPP/>
- [138]. Smeets, Ed., 2005. Does ICT contribute to powerful learning environments in primary education?; *Computers & Education*, 44: 343-355.
- [139]. Smith, T. W. (2004). Developing and evaluating cross-national survey instruments. In S. Presser, J. M. Rothgeb, M. P. Couper, J. T. Lessler, E. Martin, J. Martin, & E. Singer (Eds.), *Methods for testing and evaluating survey questionnaires* pp. 431-452.
- [140]. Studysols. 2017. Chief Minister CM laptop scheme phase 4 2017 online registration. Retrieved from May 6, 2017 from <http://www.studysols.pk/chief-minister-cm-laptop-scheme-online-registration/>
- [141]. Tamim, Rana M., Robert M. Bernard, Eugene Borokhovski, Philip C. Abrami, and Richard F. Schmid (2011). What forty years of research says about the impact of technology on learning: A second-order meta-analysis and validation study. *Review of Educational Research*, 81(1), pp. 4-28.
- [142]. Tawalbeh Mohammad, 2001. The policy and management of information technology in Jordanian schools; *British Journal of Educational Technology*, 32(2): 133-140.
- [143]. Tearle P., 2003. ICT implementation: what makes the difference?; *British Journal of Educational Technology*, 34(5): 567-583.
- [144]. Teo, T. 2009. Modeling technology acceptance in education: A study of pre-service teachers. *Computers & Education*. 52(1): 302-312.
- [145]. The News. 2008. HEC to provide high-speed internet access to universities. *International Daily Newspaper "The News"*, May 25, 2008. Online available at: <https://www.thenews.com.pk/archive/print/113636-hec-to-provide-high-speed-internet-access-to-universities>.
- [146]. Tomkinson B., Engel, C., & Tomkinson, R. 2006. Extending Our Boundaries: Higher Education and New Solutions for Complex Problems. Paper delivered to 31st IUT Conference, Dunedin.
- [147]. Tondeur, J., M. Valcke and J. Van Braak, 2008. A multidimensional approach to determinants of computer use in primary education: teacher and school characteristics; *Journal of Computer Assisted Learning*.
- [148]. Tondeur, J., Van Braak, J., & Valcke, M. (2007). Curricula and the use of ICT in education: Two worlds apart?. *British Journal of Educational Technology*, 38(6), 962-976.
- [149]. Toprakci, E. 2006. Obstacles at integration of schools into information and communication technologies by taking into consideration the opinions of the teachers and principals of primary and secondary schools in Turkey. *Journal of Instructional Science and Technology(e-JIST)*. 9(1): 1-16.
- [150]. Toro, U., & Joshi, M. (2012). ICT in Higher Education: Review of Literature from the Period 2004-2011. *International Journal of Innovation, Management and Technology*, 3(1), 20.
- [151]. UNESCO,(2002), 'Open And Distance Learning Trends, Policy And Strategy Considerations', 14 UNESCO
- [152]. UNESCO. 2014. Information and communication technology (ICT) in education in Asia: A comparative analysis of ICT integration and e-readiness in schools across

- Asia. Montreal: UNESCO Institute for Statistics. Retrieved April 18, 2017 from <http://www.uis.unesco.org/Communication/Documents/ICT-asia-en.pdf>
- [153]. Usluel, Y.K., P. As\_kar, and T. Bas, 2008. A structural equation model for ICT usage in higher education. *Educational Technology & Society*. 11: 262-273.
- [154]. Valasidou A, Sidiropoulos D, Hatzis T, Bousiou-Makridou D .2005."Guidelines for the Design and Implementation of E-Learning Programmes, Proceedings of the IADIS". International Conference IADIS E-Society 2005, 27 June- 30 June, Qawra, Malta.
- [155]. Valk, J., A.T. Rashid, and L. Elder. (2010). Using mobile phones to improve educational outcomes: An analysis of evidence from Asia. *The International Review of Research in Open and Distance Learning*, Vol. 11(1), pp. 117-140
- [156]. Voogt, J. (2004). Consequences of ICT for aims, contents, processes, and environments of learning. In *Curriculum landscapes and trends* (pp. 217-236). Springer, Dordrecht.
- [157]. Walmiki, R.H., & R. Krishnegowda. 2009. ICT infrastructures in university libraries in Karnataka. *Annals of Library and Information Studies*. 56: 236-241.
- [158]. Washington DC. 2000. "Report of the Web-Based Education Commission".
- [159]. Wheeler, S. 2004. Information and communication technologies and the changing role of the teacher. *Journal of Educational Media*. 26(1): 7-17.
- [160]. Wilkins, S., Shams, F. and Huisman, J. (2012). The decision-making and changing behavioural dynamics of potential higher education students: the impacts of increasing tuition fees in England. *Educational Studies*, 39(2), 125-141.
- [161]. Young, J. 2002. The 24-hour professor. *The Chronicle of Higher Education*. 48(38): 31-33.
- [162]. Youssef, A. B., & Dahmani, M. 2008. The impact of ICT on student performance in higher education: Direct effects, indirect effects and organisational change. *RUSC. Universities and Knowledge Society Journal*. 5(1): 13.
- [163]. Yusuf, M.O. 2005. Information and communication education: Analyzing the Nigerian national policy for information technology. *International Education Journal*. 6(3): 316-321.
- [164]. Zakaria, N. A., F. Khalid. 2016. The Benefits and Constraints of the Use of Information and Communication Technology (ICT) in Teaching Mathematics. *Creative Education*. 7: 1537-1544.
- [165]. Zhao, Y. & Cziko, G. A. (2001). Teacher adoption of technology: a perceptual control theory perspective. *Journal of Technology & Teacher Education*, Vol. 9, No. (1), Pp; 5-30

12/23/2022