
Impediments to the Integration of ICT in Public Schools of Contemporary Societies: A Review of Literature

Shafaq Salam*, Jianqiu Zeng*, Zulfiqar Hussain Pathan*,
Zahid Latif*, and Aliya Shaheen*

Abstract

The era of information technologies has stimulated the demand of educational reform based on the use of information and communication technology (ICT). It requires explicit guidelines, vibrant objectives, mobilization of resources and political commitment at all levels of the country to achieve the desired results. However, change is not easy, it requires to overcome the impediments that hinder the successful integration of ICT in public schools. The pace of this reform is active in developed countries, while developing countries are lagging behind in achieving the required goals. The foremost purpose of this study is to highlight the barriers in the effective integration of ICT faced by developed countries in general and developing countries in particular. Reviewing the impediments to the integration of ICT in public schools may assist educators to become technology adopters in the future. Findings of the study reveal that intrinsic barriers are easy to surmount; once extrinsic barriers have been subdued successfully.

Keywords

Extrinsic & Intrinsic Impediments, ICT Integration, Public Schools, Software Education Reform

1. Introduction

The information metaphor has endeavored the speculations about the demand of educational reforms to allow future citizens to survive in the information society. Quality education is an investment for the enriched future, subsequently, societies and individuals need to be particular about investment in educational progression. The 21st century global trend of the integration of information and communication technology (ICT) in education has a great impact in this investment. Students of information society have the right to acquire quality education and to become ICT competent to survive successfully in the age of digital economy. ICT can play a powerful role in the provision of quality and equal access to education. It is the responsibility of the governments of countries to provide quality education to their residents [1]. Developed countries are successful in achieving the goals of providing quality education with the successful use of ICT in teaching and learning. However, governments of developing countries are facing challenges in bringing about educational reform with the implementation of ICT and providing quality education to all citizens of their countries.

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Corresponding Author: Shafaq Salam (shafaqsalam@yahoo.com)

* Dept. School of Economics and Management, Beijing University of Posts and Telecommunication, Beijing, China (shafaqsalam@yahoo.com, 13718688489@139.com, {zulfi2k3bcs, zahid25latif, aliya.shaheen786}@yahoo.com)

Resultantly, these countries are facing challenges to compete well in digital economy because of the dearth of digital competent workforce. Integration of ICT is a process rather than a product.

The effective implementation of ICT means that it has been implemented in all the dimensions of the process. It requires to overcome the aspects that hamper the successful implementation of ICT. In developing countries ICTs are the effective way to improve the life standard of the people by producing digital workforce. Consequently, this will help in the economic development of the country. ICT enhanced education system helps developing countries to relieve poverty and social discrimination. Governments of developing countries have a significant role in bringing about education reform. Educational reform aided by ICT requires specific guidelines, clear objectives, mobilization of digital resources and political commitment at all levels of the country to achieve the desired results.

Factors that impact the use of ICT in schools and in classrooms are influential in bringing about educational reform that are beyond the control of Ministry of Education. Henceforth, periodical assessment of the progress of ICT in educational setting is essential for policy makers to bring about necessary changes in decisions and policy. Moreover, many countries around the world are periodically monitoring the teachers' use of ICT in their classes in order to find out the gaps for bringing about changes in content and decisions of future policies related to ICT. These countries are also interested in the progress of ICT implementation with respect to the efforts of other countries [2].

The greatest challenge in the implementation of ICT in education in developing countries is to balance the educational goals and economic realities. Implementation of ICT requires large capital investment. Due to financial constraints, governments of developing countries, spend the major amount of the educational budget for the rehabilitation and maintenance of school buildings and teachers' salaries. In general, sustainable and effective implementation of ICT in education requires provision of adequate infrastructural facilities, access to technologies and their periodic updating, and professional support for teachers [1]. Countries around the world, both developed and developing, are working hard to bring about education reform by investing in terms of capital, expertise and ICT resources for the smooth integration of ICT in classrooms to make teaching and learning more conducive. However, the pace of this reform is more vigorous in developed countries while developing countries are lagging behind in getting the required goals due to other challenges in their countries [3].

In the developed and developing countries of the world, ICTs are not effective in the same way for organizations and societies. The effective use of ICT depends upon the method, purpose and its application in a right way. The affordability, availability and access to technology is different in different countries of the world. Henceforth, the adoption and use of ICT result in different problems with respect to its use in various countries. In developing countries educational institutes face problems of global responsibility with the use of ICT, interdisciplinary educational institutes related to ICTs and ICTs' sustainable developmental issues. While challenges faced by developing countries are poor governance, dearth of funds for education, over-crowded classrooms, medium of instruction, curricula and no action plan or the execution of policy [4].

This paper aims to bring together the findings and significant points from the review of the relevant available literature associated with the extrinsic and intrinsic impediments in the effective integration of ICT in public schools. This study is crucial as the expanded knowledge could provide guidance to the policy makers to take necessary measures for technology integration. Previously, most of the studies focused on the barriers in limited ways or in some specific subject areas. However, authors in this study have tried to discuss the impediments in a detailed and much broader sense, in order to give a complete

scenario of the said problem. Based on the review of the relevant papers, this study provides recommendations to overcome the impediments in the successful integration of ICT in public schools of contemporary societies.

2. Role of ICT in Education

ICTs are potentially powerful tools for educational change and reform. When used appropriately, different ICTs are said to help expand access to education, strengthen the relevance of education to increase digital workforce, and raise educational quality by helping make teaching and learning into an engaging active process connected to real life [5]. ICTs do not themselves enhance students' learning capabilities but teachers who use ICTs thoughtfully do. It's the teaching and learning requirement that need to stimulate ICT intervention, rather than the ICTs themselves [6].

ICTs play a vital role in enhancing a person's skill of collaboration, information retrieval, social interaction and civic participation [7]. In the context of twenty-first century technological changes, the use of ICT is one of the competences for lifelong learning, which people need for personal fulfilment, active citizenship, social cohesion, and employability in a knowledge society [8]. Use of ICT enhances students' knowledge and skills, foster a collaborative learning environment [9] and motivate students towards the knowledge creation learning instead of memorization of facts and figures only [10]. ICT competences are related to the degree to which people benefit from the use of computers. Consequently, the disparity in digital competence might exacerbate existing social inequalities.

The integration of ICTs in education affect the educational process while dealing with key challenges of management, access, equity, pedagogy, quality and innovation. The growing trend of using ICT in teaching practice by teachers is likely to change the strategies employed by policy makers, educators and teachers in teaching and learning process [1,4]. ICTs have the potential to empower teachers' and learners' motivation, transforming teaching and learning process from being highly teacher-dominated to student-centered, and that this transformation results in increased learning gains for students; creating and allowing of opportunities for learners to develop their creativity, problem-solving activities, informational reasoning skills, communication skills and abstract thinking skills. Since students' performance is mainly explained by students' characteristics, educational environment and teachers' characteristics, ICTs may have a positive impact on these determinants and consequently the outcome of education [11].

ICT has the great potential to bring about the educational reform, enhancing teachers' teaching practice, with ICT mediated lessons, redefining the roles of teachers and students in the teaching and learning process while creating a collaborative learning environment in classrooms [12].

ICTs have the potential to innovate, accelerate, enrich and deepen students' skills, to motivate and engage students, enhance students' knowledge and create economic viability for tomorrows' workers. This in turn would better prepare the learners for lifelong learning as well as to improve the quality of teaching and learning. ICTs can be used to prepare the workforce for the information society and to meet the challenges of global economy. However, it is not easy to bring all those advantages in to realization. There are many hurdles at every step of the actual implementation of ICT depending upon the scenario of the developed and developing countries that are discussed in the following sections.

3. Classification of Impediments in the Integration of ICT in Education

Impediments can be defined as something that interfere with movement or progress. Impediments to ICT integration have been categorized by various researchers in different ways and they have used the word barriers in their research papers. Pelgrum [2] categorized these impediments as material or non-material. The material impediments are inadequate ICT infrastructure like computers and copies of software. Non material obstacles are lack of ICT knowledge and skills of teachers, lack of time and lack of awareness of relating ICT with pedagogy. Some studies divided these impediments as extrinsic and intrinsic barriers. According to Ertmer [13], extrinsic barriers are cited as time, access, support, training and resources and are referred as first order barriers. Intrinsic barriers are cited as teachers' attitude and beliefs, resistance to change and are referred as second order barriers.

Another perspective of the classification carried out by [14] is teacher level barriers (individual) such as lack of time, resistance to change, lack of confidence or school level barriers (institution) such as lack of training and lack of access to resources. However, Balanskat et al. [15] categorized them into micro level barriers that is teachers' attitude towards ICT, miso level barriers related to educational institutes and macro level barriers related to broader educational perspective. For this study, authors approached the method used by Ertmer [13] that is extrinsic and intrinsic barriers. However, few more points were added in both classifications. The purpose was to give a broad scenario of the extrinsic and intrinsic impediments faced by contemporary societies in the integration of ICT. Lack of policy and planning, lack of training opportunities, lack of technical support, dearth of funds, access to internet/electricity, language and curricula issues were included in extrinsic barriers. Intrinsic impediments were related to teachers such as lack of time, lack of confidence (knowledge and skills), resistance to change and lack of accessibility. These impediments are discussed in detail in the following sections.

3.1 Extrinsic Impediments

3.1.1 Lack of policy and planning

An important key factor hindering the successful integration of ICT in public schools is the well-defined educational policy and planning especially depicting the ICT integration. Systematic implementation of ICT depends upon the educational policy makers' perception and vision, towards the use of ICT in school culture [16]. Inadequate ICT planning and strategies may hinder teachers' efforts to implement ICT into their teaching practices in classrooms [17]. Similarly, educational policies should include mechanism for incentivizing and rewarding the teachers' use of ICT in classes and it should be the part of professional development of teachers. ICT policies and strategies need to be developed to facilitate its utilization in education [15]. Tondeur et al. [18] put emphasis on the schools' shared vision for ICT implementation, stable strategies and teachers' consideration of school policies for ICT implementation. ICT policy helps in the establishment of school culture for the effective implementation of ICT [19]. A strategic policy and planning is required to introduce ICT based curricula for the use of ICT in education [19]. In a study about four schools, carried out by [20], highlighted the importance of shared vision and ICT policy for schools' heads and teachers in providing guideline and a clear goal for the successful integration of ICT. In developing countries, like

Bangladesh, absence of concrete policy for the implementation of ICT in schools is a major barrier in taking initiative for the provision of technical resources in schools [21].

ICT has become an important part of education reform as many governments around the world have made strategic plans to allocate more funds for education for the provision of ICT resources in schools. However, the fact is that educational reforms of many countries regarding the adoption of ICT lack a solid rationale. Instead of focusing on the efforts of teachers to use ICT in their teaching practice, teachers lack the idea of using ICT effectively in the classrooms [22]. More often, integration of ICT is taken as vague conceptions about the desired learning enhanced by technologies. There is a lack of shared vision among policy makers and educationalists about the use of ICT in education [23]. Consequently, there seems no point in providing ICT infrastructure in schools unless proper rationale is not set [24]. There is an urgent need of a shared vision for the use of ICT in teaching and learning [25,26]. Teachers engaged in developing ICT planning have a constructive role in the application of ICT in a novel way [27]. An assessment and an evaluation approach is needed to find out the ambiguities in the use of ICT and make necessary changes for its successful integration [28]. Setting of goals and the provision of means for achieving the goals are crucial when making ICT policy and planning for schools [29].

3.1.2 Lack of training/professional development opportunities

The literature about the barriers of ICT integration focused more about the lack of training or the professional development of teachers [14,15,30,31]. One of the findings of the study of Pelgrum [2] was the lack of enough opportunities for teachers to acquire ICT based training. Similarly, teachers of the Turkish schools lack adequate ICT training [32]. Issues related to the training of teachers are sufficient time for training, didactic training to relate curricula with ICT and basic ICT training skills. It is worth important to provide pedagogical training to teachers rather than simple training them about the use of ICT tools [14]. Teachers who have attended professional development courses related to ICT were not confident enough to relate ICT with their lessons. They explained that these courses were mainly about basic ICT skills and did not train teachers how to incorporate these ICT tools with their lessons. Therefore, inappropriate teachers' training programs are not helping teachers to prepare ICT based lessons and to use these tools effectively in their teaching practice [15,31]. However, some initial training is essential for teachers for developing basic skills and knowledge about computers, this will help in changing their attitudes towards the use of ICT in teaching [24]. Lack of opportunities hampers teachers to acquire the ICT based training although they are willing to learn about the use of new technologies [30]. Consequently, training courses offered by some institutions are not meeting the learning needs of teachers and moreover, they are not updated regularly [15].

Training institutes should combine the pedagogical content with technology in their training courses in order to train teachers with the use of ICT resources in their respective subjects [33]. The role of teachers in the 21st century involves the application of technological innovations in their teaching process [34]. Teachers' training programs must be prepared according to the didactic content and support teachers' beliefs about the use of ICT for enhanced students' learning [10,35].

It is useless to provide ICT resources in schools unless teachers are not trained with basic ICT skills and knowledge [36]. According to the research carried out by Unal and Ozturk [37] in Turkey, teachers complained about the training courses that these in service training courses were about the use of ICT

tools but lack the requirements of relating ICT tools with didactic contents. Technical knowledge and skills, pedagogical skills supported by technology, classroom management, regarding the use of technology are some of the parameters related to the knowledge and skills necessary for teachers. Lack of these factors hamper teachers' use of ICT in classes [38]. When teachers are sufficiently comfortable with the use of technologies and have required knowledge and skills, they develop positive attitudes to use ICT tools successfully in their classrooms [39]. A study conducted by Hudson and Porter [40], in New Zealand and Australia for identifying the barriers to the use of technologies. According to them, lack of professional development and lack of experience in using technologies prevent Mathematics teachers for using ICT in their teaching practice

Teachers' enthusiasm and willingness to the use of technologies will motivate them to integrate ICT tools in their teaching practice [20,41]. ICT based teachers' training must be relevant to pedagogy, applicable to classroom instructions and related to the school policy [6,27,42].

Sheila et al. [43] carried out their research in twelve public secondary schools of Nairobi (Kenya) to explore the possible challenges and opportunities for mathematics teachers in using ICT in their teaching practice. According to them, teachers faced challenges of developing technological skills and self-training for using ICT in their teaching practice. Hence, lack of provision of opportunities for capacity building of teachers was a major impediment in the integration of ICT.

3.1.3 Lack of technical support

While dealing with ICT tools, teachers face technical problems that prevent them from using ICT. Hence, timely assurance of technical support may help teachers in saving time and smooth delivery of lessons in classes. Technical barriers include internet connection failure and malfunctioning of ICT tools. Many respondents in various studies conducted by different researchers showed their concerns about technical faults and lack of technical support [14,30,44,45]. Teachers argued that fear of breaking down of ICT tool during a lesson might discourage them from using ICT in their teaching practice [30]. In some western countries schools are provided with technical support to help teachers in using ICT effectively [45].

Technical support is crucial before the provision of ICT resources in schools so as to provide timely elucidation for technical faults. Providing resources to schools is not sufficient for effective use of these resources. As teachers without the technical knowledge and skills need assistance and guidance of technical personnel. Moreover, maintenance of ICT resources also requires the presence of these technical personnel for the swift retrieval of the technical problem [19]. Furthermore, even when schools are provided with ICT resources and teachers are using these resources effectively, if technical faults arise, this will interrupt the smooth delivery of lessons and will waste time until the problem is resolved [20].

Although ICT training is beneficial for teachers but lack of technical support concerns teachers. Therefore, there must be proper mechanism of providing technical support to teachers for encouragement of using technologies [38]. In this respect, ICT coordination and support is mandatory in schools for the effective use of ICT [46].

3.1.4 Dearth of funds/cost of ICT infrastructure

Digital education is beneficial for countries with poor infrastructure [47]. Moreover, investing in ICT for education is cost effective, with the decreasing cost of ICT resources. However, it is difficult for

developing countries with poor economies to bear the cost of hardware/software, maintenance, up gradation and providing ICT training to teachers [48]. Balancing the educational goals with economic realities is a challenging task for poor countries [49]. Acquisition of high cost of ICT infrastructure and maintenance of equipment is a key barrier in the adoption of ICT in schools [50].

Not only the acquisition and maintenance of ICT resources is costly to achieve but the provision of physical infrastructure in schools is also a major challenge. The physical infrastructure includes IT laboratories and furniture. ICT resources require the physical infrastructure to be in proper place before the implementation of ICT equipment [49]. However, in some developing countries like Kenya, schools are deficient in physical infrastructure like IT laboratories and furniture. Access to internet is costly as well as more than 90% of educational software requires proper licensing and the annual renewal which is difficult for the government of Kenya to compensate in limited funds for educational purpose. Moreover, standard educational software is expensive and are not widely available. It is also challenging to customize the relevant software according to the local educational requirements for teaching, learning and administrative tasks [48]. Educational software and ICT tools are expensive and it is hard for the government of Bangladesh to meet these expenses. A substantial amount of fund is needed for the implementation of ICT in the public schools of Bangladesh [21]. Inadequate funding for software and hardware, maintenance and hiring personnel for technical support is a major impediment in the adoption of ICT [36]. Inappropriate funding and lack of technical training of teachers are impediments in the use of ICT in schools of India [51]. Poor funding for educational sector hamper the provision of ICT infrastructure in schools [52-54].

Governments of developing countries should allocate adequate funding for education sector. These countries need to invest heavily in the internet business for the low-cost internet in schools. Scarcity of funds and high cost of ICT resources are the key challenges in the implementation of ICT in secondary schools of Nigeria [55]. Low budget for education and poor governance for the mismanagement of educational resources are the key challenges in adapting ICT in education in South Africa [4]. For the provision of quality education in the developing countries, lack of ICT resources is a major impediment in the integration of ICT. The research carried out by Nomsa [56] in Swaziland in 42 schools, revealed that dearth of funds by the government for education sector hamper provision of ICT infrastructure and teachers' use of ICT in teaching and learning. Similarly, in Pakistan, lack of substantial amount of funds for education sector impede the integration of ICT in public schools [57].

3.1.5 Electricity/Internet issues

For the effective use of ICT tools in classrooms, access to electricity and internet is crucial. Most of the rural schools of Kenya are deprived of electricity and internet. The same situation prevails in most of the developing countries of the world [48]. In a recent study carried out by Aguyo [58] in Kenya, the provision of electricity and internet is a key challenge in implementing ICT in schools. However, Rebecca and Marshall [59] stated that in some slum areas of India, schools were provided electricity with solar panels, where electricity was not available. Most of the rural schools of Bangladesh are deprived of electricity and internet access [21]. Power interruption and low-connectivity of internet impedes the teachers' use of ICT in classes [52,53]. In the age of technology, it is imperative for teachers to use ICT in their teaching practice, however, due to power failure and slow internet connection in Pakistan, teachers face problems in using ICT effectively in their classes. This situation is alarming in

rural areas of Pakistan as most of the public schools of rural areas are deficient in the provision of electricity and internet [57].

3.1.6 Curricula/language issues

Curricula and medium of instruction are other major impediments in the effective implementation of ICT in schools. Public and private schools of developed countries follow the same curricula and having the same medium of instruction. Therefore, citizens of these countries receive quality education of the same standard. The situation is quite different in developing countries of the world where there is a prominent difference in the curricula and medium of instruction in public and private schools and providing inequitable quality of education to the citizens of these countries. This results in the digital divide and social discrimination among the citizens. Research shows that 80% of software and online content are in English. This is a serious barrier for countries where English is not the first language like India and Pakistan [60]. This limits the access for people who are not fluent in English. The country of Bangladesh with poor economies and low literacy has the problem of language and curricula. Schools are offering education with local curricula in Bangla language. Since standard software are designed in English, availability of software in the local language and curricula are hampering the successful implementation of ICT [21,61,62]. Outdated curricula and medium of instruction are stumbling blocks to adopt ICT in education in Nigeria [55]. Medium of instruction and outdated curricula remain the main hurdles in the integration of ICT in public schools of Pakistan [57].

3.2 Intrinsic Impediments

3.2.1 Lack of time

Various researchers have found time limitations as a major impediment for using ICT by teachers [14,30,31,63]. Most of the teachers were of the view that they require more time for web browsing and the preparation of lessons accordingly. Moreover, dealing with technical issues and obtaining the required training needs time [14]. Similarly, many teachers argued that due to insufficient time they are unable to browse internet sites, explore the educational software and prepare the technology interceded lessons. Teachers pointed out that the preparation of traditional lessons require less time as compared to the lessons aided by the use of technologies [30]. In Bangladesh teachers have heavy workload of multiple classes and hence are unable to arrange technology material and prepare lessons by using ICT [12]. Similarly, Wong [64] investigated about the perspectives of primary teachers regarding the use of ICT in Hong Kong. He stated that teachers lack time to use technology in their classes. Hence, using ICT in classes would be unsuccessful because of insufficient time of teachers [65].

In Saudi Arabia, teachers argued that limited class time of 45 minutes is insufficient to use ICT, secondly, use of ICT tools wastes time, moreover, classes are overcrowded and usually teachers loose class control when using ICT [66]. Therefore, the class time should be extended and curricula must be reduced so that teachers can get ample time to use ICT tools while delivering their lessons [33]. Teachers have insufficient time for course planning. If teachers' time is strictly fragmented or limited with the number of classes, then teachers are unable to learn new skills and develop new methodologies for teaching [36]. Insufficient time due to the overburdened time table and other school responsibilities hamper teachers to take out time for searching on internet and use of computers for teaching aid

[19,67,68]. In Bangladesh, teachers are overburdened because of taking classes in two shifts. They are also engaged with administrative tasks. Resultantly, teachers do not have time to collaborate with peers, to learn the use of ICT tools and software and to plan their lessons accordingly [21,39,69]. In Swaziland, teachers in schools teach number of subjects along with teaching ICT. Therefore, it is hard for them to manage and design ICT mediated lessons for different subjects [56].

3.2.2. Lack of confidence (knowledge and skills)

Teachers' confidence about using ICT in classes is an obstacle that impede the successful implementation of ICT in schools even if ICT resources are available. Teachers' fear of failure is the cause of lack of confidence [70]. Lack of ICT knowledge makes teachers feel conscious about the use of ICT in teaching [15]. Most of the respondents were afraid of entering the classroom with limited ICT skills [14]. Limited experience with technology hamper teachers' confidence about using ICT in the class [15,71].

Teachers' competence is also another impediment related to the teachers' confidence about the pedagogical use of ICT [15]. Many teachers were not enthusiastic about bringing computer into their classes for teaching due to their limited knowledge and skills [15,19,24,72-74]. Organization of a relevant topic through the blending of content and pedagogy adapted according to the diverse interests and abilities of learners is the successful implementation of ICT by teachers in their classes.

Some studies reveal that the level of lack of confidence of teachers varies from country to country as this barrier is notably at high level in developing countries [2,72]. For example, in Syria, this barrier was cited as the major barrier by [73]. Similarly, in Saudi Arabia, Al-Alwani [63] found it as a main barrier. The results of the study of Balanskat et al. [15], carried out in Denmark, showed that due to lack of ICT skills, teachers avoid using ICT in their classes. However, in Netherlands, lack of confidence was not a major barrier for the integration of ICT in education.

Classroom management skills are vital when bringing technology into classrooms. These classroom management skills are related to the engagement of ICT tools in classrooms. Besides this, teachers need to practice and learn about the organization of the classroom effectively to provide equal provision of access to all students as well as to tackle technical issues while dealing with ICT equipment [19].

Ottenbreit-Leftwich et al. [75] mentioned another type of knowledge and skills that is pedagogical content supported by technology. Teachers need to understand the relationship between the teaching strategy and the type of technology being used. Other researchers added another phenomenon of content knowledge along with the technology and pedagogy. This means that teachers must have relevant skills to use technology related to the content of the subject in their teaching strategies [76]. Teachers are deficient in using technology and are ignorant of relating didactic content with technology. The reason for the failure of teachers' benightedness about the connection of pedagogical content and the use of technologies is that professional development courses mainly focused on the use of ICT resources [19]. Therefore, professional development courses should focus on the provision of courses bases on pedagogical and content knowledge with the use of technologies [15].

Educational reform with respect to ICT require ample technological skills and knowledge of teachers. The successful integration of ICT in education requires subject specialist expertise, an understanding of learning capabilities and needs of students, and an adequate knowledge and skills about the use of ICT tools. However, teachers in Bangladesh lack these capabilities, therefore, absence of required knowledge

and skills is impeding the integration of ICT in schools of Bangladesh [21,41,69,77].

The study of Triggs and John [78] divulged that teachers contact with peers for the exchange of knowledge and experience, an encouragement for using ICT, an analysis of complications faced by the use of technologies and a guidance for improvement, stimulate teachers' use of technical resources.

Teachers' knowledge and skills and their confidence about using technology will benefit children in getting digital competence. Therefore, teachers need to learn not only the use of technology but also to learn the exact application of technology related to curricula [79]. Teachers' digital competence and lack of access to ICT resources were found to be major obstacles in using ICT in classes by teachers in Ghana [80]. Teachers' self-efficacy or digital competence can open up new ideas for using ICT in their teaching practice and for the enhancement of their teaching methodologies. However, teachers with the lack of digital competence or lower self-efficacy are hesitant to use computers and get frustrated when they encounter problems [35,49]. Teachers' competence and their positive attitude towards the integration of ICT in their teaching practice can help in the successful implementation of ICT in classes [81]. According to results of the study of [82], carried out in five public secondary schools of Bahry province of Sudan, for highlighting the major obstacles in the integration of ICT, revealed that the type of ICT training which teachers acquired was mainly about the basic ICT knowledge and skills, and teachers were ignorant of relating ICT tools in their daily teaching practice.

3.2.3 Resistance to change/teachers' attitude and beliefs

Teachers' attitude and beliefs play a significant role in bringing about didactic change related to the use of ICT for teaching and learning. The results of the study of Schoepp [31], indicated that teachers believed that they were not being rewarded, supported or guided by the use of technology in their teaching practice. Not all countries have similar problems. In Europe that only few teachers were opposed of using technologies. The fact is that teachers are not guided about the need for didactic change and are not provided with the opportunities for making sense of new technologies for themselves [45]. Assessment of teachers' beliefs and attitudes towards the use of technologies is critical before the provision of ICT resources. Moreover, reforms in education policy regarding the technological planning must include some strategies to change the teachers' attitude and resolving their fear factor towards ICT. Teachers' motivation for professional development and strong commitment to their students' learning can help in the effective integration of ICT [36].

Teachers' perception about the use of ICT in the class, ease of the use of available resources and incentive to pedagogical change by the school and policy makers are great hurdles in the integration of ICT in schools [83,84].

Limited availability of resources in schools are hampering the teacher's use of ICT. Lack of ICT resources in the classrooms results in the lack of digital competence of pupils. Provision of ICT training to teachers and the availability of digital resources motivate teachers to help their students in the construction of knowledge rather than imparting knowledge. While bringing technology into classrooms, there is an urgent need to change the teachers' attitude towards the use of technologies as teachers are at the forefront when it comes to enhance their teaching practice with the use of ICT. Therefore, teachers' positive attitude can bring about an enhanced learning environment [3].

In the instructive teaching practice teachers are the transmitter of knowledge and have little interaction with students because of imparting knowledge via 'chalk and talk' mode [10]. However, in

the constructive teaching practice, teachers act as facilitators and encourage students to learn independently and help them in solving challenging problems, this will also help students in the construction of knowledge rather than gaining knowledge [85,86].

3.2.4 Lack of accessibility

Inadequate amount of ICT resources creates this type of barrier if these resources are not available in time to users (teachers and students). In a study carried out by Sicilia [30], teachers complained about the inaccessibility of computers due to several periods (classes) in a row and could not work on computers as they were shared by other teachers or they were in use by other teachers. Poor organization of ICT resources, inappropriate software, non-maintenance of ICT resources re some factors of inaccessibility to these resources. No access to internet and scarcity of pedagogical software were impediments in the use of ICT in Saudi schools [63]. About one third of the European schools do not have access to Internet [45]. However, accessibility to ICT resources does not mean that it is being applicable successfully but quality of hardware, inappropriate software and access to ICT tools by all users are some other barriers hampering the effective implementation of ICT in schools [84].

For the successful implementation of ICT, accessibility to ICT resources and the pedagogical relevance of these resources are necessary. Limited availability of resources in schools are hampering the use of ICT by teachers. Provision of ICT training to teachers and the availability of digital resources motivate teachers to help their students in the construction of knowledge rather than imparting knowledge. Bangladesh, being the developing country is facing challenges in the integration of ICT in education. So far, due to poverty, health and developmental challenges, education sector is facing problems of the provision of ICT resources in schools. Apart from this, internet access is also very poor in schools, therefore, teachers are unable to make innovations in their teaching strategies with the use of ICT tools [65]. A study was carried out by Salehi and Salehi [53] in thirty high schools of Isfahan (Iran) to explore the challenges faced by English teachers while integrating ICT. The results of the study revealed that high school teachers were about the use of ICT but due to lack of resources, they were unable to adopt ICT in their teaching practice. A research carried out by Mathevula and Uwizeyimana [87] in 12 secondary schools of Limpopo province of South Africa revealed that lack of insufficient ICT resources hamper teachers' confidence in using ICT. Moreover, few teachers were ICT trained but lack of resources negatively impact teachers' willingness for using ICT in their teaching practice.

4. Discussion and Recommendations

The introduction of new technologies and the increased use of internet, has made possible the integration of ICT in schools in the developed countries. Since 1980s, formulation of policies, computer aided teaching and learning, research and communication have been continuously progressing in these countries. However, the pace of bringing educational reform based on ICT is very slow in developing countries. This study was carried out to bring together the findings from the review of the relevant literature associated with the impediments to the integration of ICT in public schools across the world. Most of the studies focused on the dearth of funds for education sector in developing countries. In order to compete well in the technological era, majority of the developed nations are striving hard to

raise the standard of education. These countries are allocating substantial budget for the provision of ICT infrastructure and are paying attention for the professional development of teachers.

Moreover, education policy and curricula are revised periodically to meet the demands of the present era. However, this situation does not prevail in the developing countries, due to dearth of funds, provision of ICT resources is hard to provide in public schools. Although education policy focuses on the provision of ICT resources and ICT trained staff, but due to lack of funds, these targets are hard to achieve. Additionally, teachers' training programs and curricula are traditional and are not updated periodically. In most of the remote areas of the developing countries, access to electricity and internet is formidable. Among the intrinsic barriers, teachers' attitude and lack of confidence about the use of ICT are very important to solve. Following recommendations have been made to solve the problem for the effective integration of ICT in public schools of contemporary societies.

- Governments of developing countries should allocate more funds for education sector.
- Cost of infrastructure can be reduced by adopting measures such as locally assembled hardware/software to avoid reliance on imported one.
- Education policy and curricula should be revised periodically to meet the demand of the present era.
- Teacher training programs must be based on the use of ICT for all subjects.
- Alternative means of electricity must be provided in the remote areas of developing countries.
- Teachers' attitude towards the use of ICT and lack of confidence can be reduced by professional development courses.
- Lack of time for the use of ICT for all subjects can be solved by hiring more staff and reducing the curricula.

On the whole intrinsic barriers are easy to surmount; once extrinsic barriers have been subdued successfully.

5. Conclusion

Educational reform through ICT requires large capital investment in order to facilitate public schools with ICT infrastructure, ICT trained teaching staff and the periodic upgrading of the curricula and education policy. A concrete vision is crucial for the policy makers to take necessary measures for the successful integration of ICT. Moreover, professional development of public school teachers will help in changing the teaching practice from teacher-centered towards the student-centered and will help students in the construction of knowledge rather than imparting knowledge. This will be beneficial in providing quality education and will help in producing digital competent workforce to improve the life standard of citizens and the economic development of the country.

6. Future Work

In future, author will put effort to investigate the hindrance of teachers' willingness of the integration of technology and provide suitable implications in order to successfully implement in public schools of Pakistan. Since teachers are the policy implementers; hence it is very important that teachers are

comfortable with the use of technologies. However, use of computers and laptops are considered complex by the majority of people, therefore, we will work on the integration of ICT using smart phones in order to implement ICT successfully in public schools.

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Shafaq Salam <http://orcid.org/0000-0002-3233-6866>

She is a PhD scholar at the School of Economics and Management, Beijing University of Posts and Telecommunications, Beijing, China. She worked at Beaconhouse School System, Peshawar, Pakistan as an education expert. Her areas of interests are education development and advanced technologies in education system.



Jianqiu Zeng

He obtained his Ph.D. degree from Cambridge University, UK. He is a professor and a doctoral advisor in the School of Economics and Management of BUPT and also the Director of Information Economy and Competitiveness Research Center.



Zulfiqar Hussain Pathan <https://orcid.org/0000-0002-3687-6456>

He had received his B.S. in Computer Science and M.S. degrees in Technology Innovation Management from Mehran University of Engineering & Technology, Jamshoro, Pakistan. Since September, 2014, he is a PhD scholar at Beijing University of Posts and Telecommunications.



Zahid Latif <https://orcid.org/0000-0001-6735-7555>

He is a PhD scholar at Beijing University of Posts and Telecommunications, China. He has been working in telecommunication sector of Pakistan since 2003. His research interest areas are Information and Communication Technology, one Belt, One Road, China-Pakistan Economic Corridor and ICT diffusion in Pakistan.



Aliya Shaheen <https://orcid.org/0000-0002-6936-3446>

She is a PhD scholar at the School of Economics and Management, Beijing University of Posts and Telecommunications, Beijing, China. She did her masters of science in project management from COMSATS Institute of Information and Technology. Her areas of interests are education and management science.