Enhancement of Teaching-Learning with Cloud Computing in Indian Primary Education System

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Abstract

The 4.0 industrial revolution is going with the high technological era; the internet access spread reaches high in the developed as well as developing countries. The technology is completely dominating the human social life. It is not matter of literate and illiterate, every human being is associated with the technology through internet access. The internet accessibility is the goal to make easy tasks regarding help the poorer of the community leapfrog their way out of poverty, enhance awareness about crops and prices for farmers, search new way to make safe reproductive health of women and enhance teaching-learning from primary to higher education. Novel technological advancement becomes key importance in education system in developing country like India. The education system is based on practical and information and communication technology (ICT). The paper examines the government's new concept of smart class with digital tools and ICT concept in education system. Government declared free and compulsory primary education for all and also introduced new programs like digital education, e-learning, smart class across the country. This paper is tries show crucial need to adoption digital technologies such as Cloud Computing at the primary education system in rural India. Moreover, Cloud Computing should become important tool to enhancement of teaching-learning process with low investment for Indian education system.

Key Words: Technological Innovation, Education, ICT, E-learning, Cloud Computing

Introduction

The era of digital revolution brings various digital technologies in area of education to improve quality as well as enhance the knowledge and new ideas. Technology can play an important role to establish an equal and quality based education system. Quality education is an investment for the reform and enriches future of individuals. Education and digital technology both are linked to each other. Both are the process of learning and one becomes an instrument to learn other thing. In 2012, the government of India formulated a national

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policy on ICT enabled school education with the purpose of enhance creativity of youth and socio-economic development of nation. An initiative by the National Mission on Education through Information and Communication technology (NME-ICT) taken for holistically change the educational environment of the country. However, the challenge of ICT in primary and secondary schools include various scarcities of resources such as lack of funding, lack of skilled personal, poor ICT infrastructure, unmanaged and unsystematic maintenance of hardware and software, lack of motivation and confidence and lack of awareness regarding benefits of ICT in education (Richardson, 2011).

The present scenario, whole primary to higher education system of India considered as major support system of socio-economic growth for India. Moreover, the size Indian education system has been increased every year. Nevertheless, government dramatically decreased budget on education without any concern about poor citizen of the county. The primary to higher education system of India has facing issues of financing, poor management level and education quality. Consequently, Cloud Compositing is one of the crucial technology for the enhancement and development of Indian education system. Various advantages of utilizing cloud computing in education system that include increased transparency, enhanced management of policy and improved quality of education with low budget. Utilization of cloud in educational institution would reduce the costs drastically (Boja et al, 2012). There is a crucial need of changing and adoption of novel educational technology, specifically for the development of examination systems, electronic student records and e-learning. Cloud Computing based registration, examination and evaluation systems are rapidly becoming a leading trend for the educational information system worldwide, bringing positive change in the structure and nature of the educational system (Kuo, 2011).

History of ICT Enabled Education System of India

Since the independence of India, the government of India has initiated various programmes and policies to integrate technology in education. The importance of ICT involvement in education as early felt in 1984-85 with the introduction of Computer Literacy and Studies in Schools (CLASS) under the Ministry of Human Resources Development in collaboration with the Department of Electronics (Lakshmi, 2016). By this project 12000 secondary and senior schools were beneficiated. Under this project primary schools were alienated to the technology based education (Das, 2012). The project was adopted as centrally sponsored schemes during the 8th Five Year Plan (1993-1998) for enhance the number of computer to

provide computer based teaching-learning. However the National Policy of Education 1986 is measured the first step to promote technology based education in the history of education in post-independence (Ibid, 2012). It stressed on the need of radical changes in the education system to improve quality of education and gave much greater attention on science and technology-based education (NPE, 1986). The national Policy on Education 1986 is a great remark in Indian education system that modified in 1992, with the need to employ educational technology to improve the quality of education. In 1992 programme of Action (POA) on NPE stressed the need to improve access to computers in schools (Ibid, 1986). In 1998 by the prime minister of India taken a step towards National Task Force on Information Technology and Software Development (NTFITSD) and introduced some technology based attractive scheme such as Vidyarthi Computer Scheme, Shikshak Computer Scheme and School Computer Scheme to inspire and initiate both teacher and students to make them tech-savvy (Lakshmi, 2016). Computer and internet was to be accessible to school too. These all policy and programmes led to two major centrally sponsored schemes, first, Educational Technology (ET) and Computer Literacy and Studies in Schools (CLASS) to competence the Information and Communication Technology in schools in 2004 (Das, 2012). Educational Technology emerged with a significant place in up gradation of science education. The main role of ICT highlighted in the National Curriculum Framework (NCF) 2005 (National Policy, 2012). The role of ICT also highlighted in Government of India's flagship programme on education, Sarve Shiksha Abhiyan (SSA). In 2005, the Central Advisory Board of Education (CABE) recommended ICT framework in school education for the purpose improving schools education in the country. The holistic development of ICT policy in school education initiated by the ICT for enhances outreach and education quality of education (Ibid, 2012). The launching of INSAT, INSAT-1A and INSAT-1B were measured as important milestones in the promote areas (C-DAC Annual Report, 2017-18). Technology based education makes more effects on learning with e-learning, smart classrooms with digital boards. Digital technology is a binary-based code of communication of the digits 0 and 1 that make a easy and fast process of communication through electronic devices such computer, tablets, smarts mobile phone etc. (Lakshmi, 2016). It enable immense amount of information to be compressed on small storage device that can be easily preserved and transported from one place to many places. Technology in education can be defined as "diverse set of technological tools and resources used to communicate and create and manage information" (Blurton, 1999).

Technological Innovation in Indian Education System

Technology in education is a process to enhance learning skill and explore teaching areas. Educational technology makes more effects on learning with e-learning, smart classrooms with digital boards (Lakshmi, 2016). Digital technology runs through information and communication technology (ICT) at various sector such industry, health and education etc. (Kundu, & Dey Kedar Nath 2018). Information and Communication Technologies are defined as all devices, tools, content, resources, forums, and services, digital and those can be transformed into or delivered by digital forms that can be use for enhancing access and teaching learning, reach of maximum resources, building of capacities as well as management of the educational system (Salam, Zeng, Pathan, Latif and Shaheen, 2018). The ICT in education first of all introduced with the Computer Aided Learning Programme (CALP) in December 2004 that mandated and established Computer Aided Learning Centres (CALCs) in middle and high schools. The state governments were bearing all the set-up and operational costs. The purpose of programme was trained to children with computer applications and provides digital learning materials (audio-visual lessons on compact disks based on the school textbooks). Firstly, the government of Puducherry set up CALCs in primary schools (Lumde, 2018, p.2).

The central government has made some initiatives for explore the technology in education with some technological agencies such C-DAC. C-DAC is a scientific society under the Ministry of Electronics and Information Technology (MeitY), Government of India (C-DAC Annual Report, 2013). C-DAC has developed a framework named "eBasta" as part of its ongoing project titled "Digitally Inclusive Smart Community" (DISC) by which school books can be accessible in digital form as e-books to the students (Twining, Davis, & Charania, 2015). The aim of the framework is reducing burden of school books, transport and delivery in a remote areas, shortening the logistic problem of books publishing and enabling more study material in e-books to the students as well as teachers (C-DAC Annual Report, 2017-18, p.33). Other various programmes such e-learning, e-books and e-Pariksha, the technology is providing different tools and methods of teaching and learning. e-Learning is a framework for children by which disabled children can get education with mild mental retardation and autism in the age group of below 16 years (Salam, Zeng, Pathan, Latif, and Shaheen, 2018). This framework is developed under the Sarve Shiksha Abhiyan (SSA) programme. Through e-Pariksha, the students get an opportunity to write exam online from school stage to graduate level (Sarkar, 2012).

One programme "Computer Aided Learning (CAL) Programme under Sarve Shiksha Abhiyan Rajya Mission" started by government of Tirpura. Under this programme the training is given to the teachers to teach with various technological methods (Rebecca, & Marshall, 2012). This initiate benefited to the school students by providing better methodology of teaching with better study material (C-DAC Annual Report, 2012-13). The government of West Bengal also developed same programme in the year 2012. In 2009, a programme "An Integrated Text-to-Speech (TTS) & Text-to-Braille (TTB) system for the visually impaired" started by Shruti Drasti. Shruti Drishti is a web page browser. It deployed successfully at 40 visually impaired women schools across India with the associated hardware/software and it trained to the visually impaired women (Margaret, Davis, Lewin, Charania, Nordin, Orlic, Butler, & Lopez-Fernadez, 2016). The programme was completed in September 2010 (C-DAC Annual Report 2009-10). The government of Punjab has placed technology at school level. In the year of 2011-12, the government deployed Bharat Open Software System (BOSS) Linux/ EduBOSS Linux in across schools under EDUSAT project of government and Pondicherry employed in 65 schools under Sarve Shiksha Abhiyan Programme (Manduku, Kosgey, & Sang, 2012). EduBOSS is an educational variant of BOSS Linux full featured, user friendly Linux operating system with educational application that is useful in schools at primary level to higher educational institutions (C-DAC Annual Report, 2014). It has features such as office applications suite, web browser, onscreen keyboard, smart common input method, graphical installer, educational games, screen reader, typing tutor, Paint and graphic tools, text to speech application and a host of tools and packages for learning and teaching (Charania, & Davis, 2016). EduBOSS focused on school education and being tested on-site in school environment (C-DAC Annual Report, 2015-16, p. 26). EduBOSS has implemented in more than 7000 public school of the state of Punjab. The Government of Haryana has also placed an order for implementation of BOSS Linux/EduBOSS across schools of Haryana under the Serve Shiksha Abhiyan Programme (Charania, 2012-2014). It has implemented in more than 5000 aided schools. The government of Maharashtra has enacted an order for implementation of EduBOSS with 60000 systems across 5000 government schools of the state in the year of 2012 (Ibid, 2012-2014). Deployment of EduBOSS Linux was implemented in all the government schools of Chandigarh (C-DAC, Annual Report, 2013-14, p. 30).

Statement of the Problem

According to Census 2011, almost 70% population still lives in rural areas in India. It is fact that the ratio of rural-urban enrolment in schools is an enormous. According to Kavishwar (2018), the Pupil Teacher Ratio (PTR) in 2009-10 32% schools were running with single teacher and in 2015-16, 24% single teacher schools continue to be a major concern in the rural India. These obstacles do not just lead to poor quality of education, but also increase to high dropout rates of children within the age of 6 years to fourteen years in rural schools. The condition of education in rural India is very poor. Furthermore, there is lack of sufficient resources such as computers, printers, scanners and internet facility etc in government schools in rural areas. The central government should initiate to enhance digital technology in the higher educational institutes to primary level schools for improve the quality of education. The paper has explored the nature of cloud computing technology in primary education in India through descriptive research tool by secondary resources.

Methodology

The paper has explored the nature of cloud computing technology in primary education in India through descriptive research tool by secondary resources. The secondary information collected from various research papers, articles, books, reports of public & private organisations and various internet recourses.

Theoretical Framework

Technology or smartness in education is emerging tool. Today, education system can assist schools to expedite the integration of digital technologies in their pedagogy and administration (Eickelmann, 2011). Digital tools in education have known as smart partnerships (SPs) that make a valuable principle to supporting the development of more equitable educational infrastructure (Charania, & Davis, 2016). The term 'smart' sounds innovative and transformative changes made by new technologies. It enhance the process of data-storing, data-driven, data-sharing and a clear and more interactive communication and collaboration (Kitchin, 2016). Fallon has pointed out that technology in education (ITE) make a "mutually satisfying relationship" which typically involves the free benefits of sharing and exchange knowledge and ideas (Goswami, 2014).

Figure 1. The global arena of change with ICT schooling
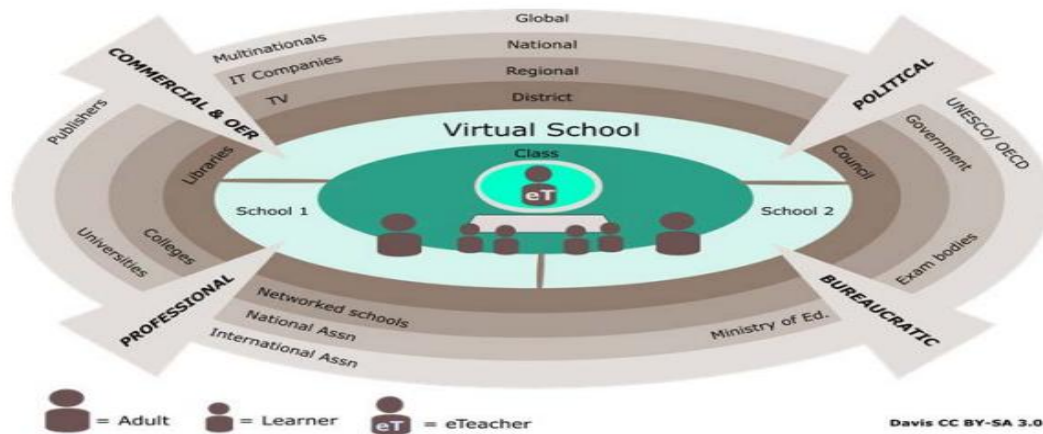
Source: Adopted from Twining, 2015, P. 6

The role of ITE is measured to develop digital technologies in curriculum and pedagogy of school and improvement of teaching and learning in most underprivileged Indian regions.

Need of Cloud Computing in Present Primary Education System

Education has obscured a central dimension of human development. It has seen most visible development efforts that make success and complete development of the world structure. The history of education shown that more children been enrolled in formal education across the world and particular in India. Today, more than 90% children are enrolled in primary schools from urban areas to some of the most remote region of the earth (Winthrop, McGivney, Willaims, Timothy, & Shankar, 2016). More students have more years of schooling but what they are learning? The Annual Status of Education Report (ASER) 2014 revealed that the ratio of enrolment of students is increasing in public as well as private school but a significant proportion of children in classes 1 to 8 in government and rural private schools are not able to read the text book of the 2nd standard students and cannot do simple arithmetic their age-group may be expected to do (Mody, 2017). So the evidences of weak quality of education have suggested that we are facing a global learning crisis. The pedagogical and curricula used in schools are not able to enhance more skill in the students. If education system fails to improve learning outcomes, it has some pedagogical faults in itself and it needs some changes in design of the way of education delivered (Winthrop, McGivney, Willaims, Timothy, & Shankar, 2016). There is a crucial need to introduce novel digital technologies such Cloud Computing to deliver education by which education system become more inclusive, interactive, and transformational and produce a high level of quality of education (Kitchin, 2016). Besides, Internet of Things (IoT), Artificial Intelligence, Big Data, Robotics,

3D Printers and Cloud Computing are emerging technologies in digital era. Likewise, cloud computing innovation added to technological breakthrough through improved products and services in Indian IT market (Buyya et.al, 2013).

Cloud Computing

India is becoming a one of the fastest growing digital economy with adoption of digital technologies in various public and private sectors. Similarly, the Cloud based service is maximizing the growth of business opportunities in digital India. Cloud Computing is also part of service sector and it is linked and equated to the '4.0 Industrial Revolution' in terms of technological innovation, structural change, and the sources of economic growth (Kshetri et.al, 2017). The Cloud Computing is one of the emerging technology and it's aimed to have access to the IT products and services anytime, anywhere by authorized user (McKinsey, 2009). Cloud based services are achieved significant popularity due to its deployment models such as private, public, community and hybrid cloud including services models such as SaaS, PaaS and IaaS in the digital world.

Cloud Computing Deployment Models

Public Cloud: The public cloud setup is open to the all public. It may be managed and operated by a firm, academic or government organization or some combination of them. **Private Cloud:** The private cloud infrastructure is setup within the premises of an institution and generally made accessible to the authorised members of the institution or a subset of them. **Community Cloud:** The community cloud infrastructure is setup for a specific group of consumers from organizations that have shared concerns. **Hybrid Cloud:** The cloud infrastructure is a composition of two or more distinct cloud infrastructures (private, public or community) (NIST, 2011; Buyya et.al, 2013).

Cloud Computing Services Models

Software as a Service: SaaS include software applications service that run on the cloud such as Google Apps and Microsoft Office 365. **Platform as a Service:** Platform means the underlying system on which software applications can be installed. A computing platform comprises hardware resources, operating system, networking system, programming languages, middleware, tools and runtime libraries. **Infrastructure as a Service:** IaaS provides the facility of remotely using processor, server, storage and network resources to the consumers through the internet (Srinivasan, 2014; Murugesan and Bojanova, 2016).

Cloud Based Primary Education

Cloud computing is an emerging technology that provide a hardware, software, network and server based services at lower cost and minimize the financial crisis faced by higher education institutes. The adoption of Cloud based services in educational institutes will overcome the cost of IT budget more than 20% per year than traditional IT setup (Pardeshi, 2014). There is a crucial need of changing and adoption of novel educational technology, specifically for the development of examination systems, electronic student records and e-learning. Cloud Computing based registration, examination and evaluation systems are rapidly becoming a leading trend for the educational information system worldwide, bringing positive change in the structure and nature of the educational system (Kuo, 2011). According to Singh (2017) the Indian school education system should examine cloud computing adoption in terms of human, technological innovation, organisational and environmental contexts. There are several advantages of Cloud services such as availability, reliability, security, privacy, relative advantage, cost-effectiveness, compatibility and top management support having a significant positive impact on the Indian school education system towards cloud adoption.

The cloud can be adapted to primary schools in India to improve the quality of overall education system. The following diagram shows the architecture of cloud adoption in government primary schools. (Bulla et al, 2016).

Figure:1.1 Cloud Adoption in Primary Education in India
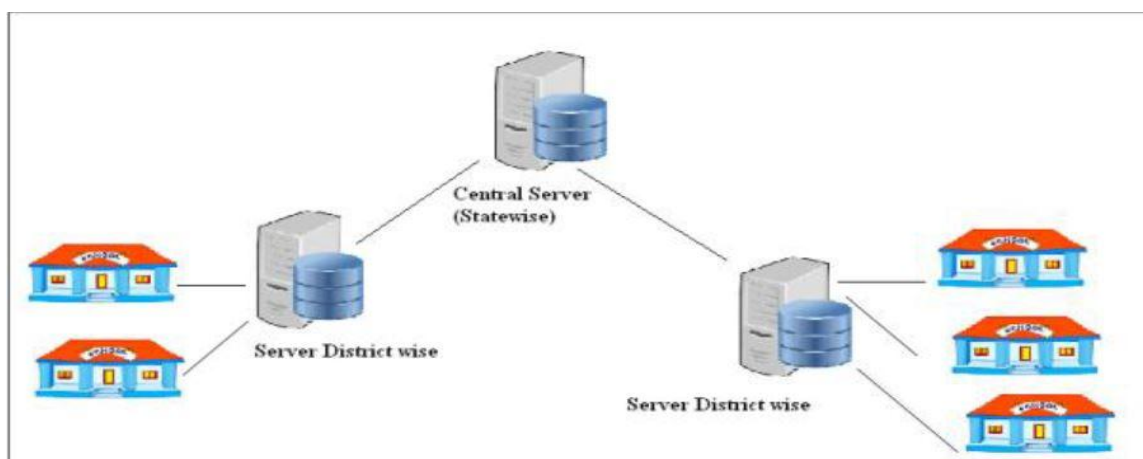
Source: Adopted from Bulla et al, 2016.

In the above figure, two types of servers are maintained to avoid availability and speed problem. The central server, timely updates the Servers that are placed in district wise. The schools will get updated resources through intermediate servers. The teacher and student can use cloud resources for academic (attendance entry and marks entry) and administration (admission, transfer, fees collection etc) purpose. The school may have smart classes so the videos and animation can directly stream from central server so all students in the state can have identical and quality education (Bulla et al, 2016).

Challenges of Technology in Education in Rural Areas

Developed countries are successful in achieving the goal of implement the technology in business and industrial era but the government of developing countries are facing challenges to implement ICT or digital technology in education sector at school levels, region and for all individuals of the country (Salam, Zeng, Pathan, Latif and Shaheen, 2018). According to Census 2011, almost 70 per cent population still lives in rural areas in India. It is fact that the ratio of rural-urban enrolment in schools is an enormous. Ajay Kavishwar pointed out that despite the Pupil Teacher Ratio (PTR) in 2009-10 32 percent schools were running with single teacher and in 2015-16, 24 percent single teacher schools continue to be a major concern in the rural India. These obstacles do not just lead to poor quality of education, but also increase to high dropout rates of children within the age of 6 years to fourteen years in rural schools (Kavishwar, 2018). The central government is initiating to enhance digital technology in the higher educational institutes to primary level schools for improve the quality of education. In India, ICT launched in 2004 with the programme of Computer Aided Learning Process (CALP) and revised in 2010. The government of India has declared 2010-2020 as a decade of innovation and technology with a special focus on ICT enabled education across the country.

In the Union Budget for 2018-19, the government has allocated 456 crore expenditure for digital education. The technology of digital boards in schools is playing a significant role to improve the quality of education. Technology is becoming necessary in even primary education. The central as well as all state governments are making a significant concern in this direction (Ibid, 2018). As per the 2011 census, nearly three-fourth of the Indian population lives in rural areas covering over 6 lakh villages. The education in rural India is very poor. The numbers of government schools are very less and private school are largely concentrated in the urban areas. In fact, majority schools in rural areas are not familiar with

technology based or smart classes and do not provide computer education at all (Kundu & Nath, 2018). Even children are helpless to get basic education in rural areas.

The National Policy on Education provided the scheme of ICT for all rural schools to integrated development for education and economic empowerment of rural students in 1986 but literature shown that still it is not implemented in its real form in India (Budhedeo, 2016). There is lack of sufficient resources such as computers, printers, scanners and internet facility etc in government schools in rural areas. A big challenge mentioned by Budhedeo that a large proportion of the technical educational software produced in the English, majority internet based study material is available in English while in the rural areas English language is not proficiency high. Salam has pointed out that ICT in schools and classrooms are influential tool to reform education process but it is beyond the control of Ministry of Education. Insufficient computer systems

In the rural areas the teachers are inadequately trained and multiple burden of work such mid-day-meal programme makes weak to the educational process (Madangopal, 2018). There are majority of older teachers compare to younger ones in public schools in rural areas who resist applying ICT in their subject (Kundu & Nath, 2018). It is evident by literature that the challenge of ICT in primary and secondary schools include various scarcities of resources such as lack of funding, lack of skilled personal, poor ICT infrastructure, unmanaged and unsystematic maintenance of hardware and software, lack of motivation and confidence and lack of awareness regarding benefits of ICT in education (Richardson, 2011). Siddharth Chaturvedi, director, All India Society for Electronics and Computer Technology (AISECT) said, "Language is a big barrier to deliver ICT based education in rural areas because still quality content in regional languages is not available". A survey has highlighted infrastructural problems in rural regions such as small size of classrooms, non-availability of continuous electric supply, availability of poor quality of hardware, software or e-content and insufficient time to integrate ICT with the knowledge sharing framework (Ibid, 2018, p. 3). A crucial factor needs to be looked into infrastructural support in schools that the central as well as state governments are making concerted efforts in the direction of E-Krinti that is a major pillar of digital India. The government of India has collaborated with various telecom service providers to empower remote areas of the country with basic infrastructural set-up for internet services. However, it is measured that only 9 percent of rural India has access to the Internet. Payal Arora pointed out that the technology is spread at highest rate in beyond the west countries. The people are using technology according to their business, the technology

also sent to remote villages with computers to enhance awareness of the potential of the internet. It is hope that the people in the villages would inspired themselves to adopt these new technologies and would able themselves towards create a better future.

Conclusion

The present study has focused on implication and adoption of Cloud Computing technology in Indian primary education system which provided computer-based learning. The government of India should take proper step for improve the management and implementation policy level by which majority of children could be benefited by Cloud based e-learning. The Proper and strong framework of technology-based educational system should be initiate by central as well as state government. ICT networks should be connect at various levels such block, panchayat and municipal by the state government and local authority. The GDP should enhance on education and particular for technology based education by the central as well as states government In the age of internet or digitalization the various areas have developing and benefiting to the people. Digitalization in education sector much needed in rural as well as urban regions because through digital tools, education can be more accessible and quality based with less efforts.

Recommendations/Policy Implications

The government of India should take proper step for improve the management and implementation policy level by which majority of children could be benefited by computer-based learning. There are many technology-based tools are using in education sector but at rural level these are failed, required for growing technology-based particular cloud-computing technological educational environment. The Proper and strong framework of cloud-computing technology can enhance teaching-learning with low budget at large level. It should be initiative by central as well as state government. The Polices should reflective with the key interest of all the stakeholders in education, learners, teachers, policymakers, educational administrators and at large multicultural communities. All should be aware of the issues concerned and willing to work towards cloud-computing technology based education. The Cloud-computing technology networks should be connect at various levels such block, panchayat and municipal by the state government and local authority. The adequate funding and professionally trained staff can effectively take the responsibility of capacity-building to modify offline education to digital education.

References

Al-Ansari, H. (2006). Internet use by the faculty members of Kuwait University. *The Electronic Library, 24*(6), 791-803.

ASER (2014). Annual Status of Education Report (Rural) Facilitated by PRATHAM, www.asercentre.org.

Boja, C., Pocatilu, P., & Toma, C. (2012). The economics of cloud computing on educational services. *Procedia Social and Behavioral Sciences, 93,* 1050 – 1054. Retrieved from http://ac.els-cdn.com/

Budhedeo, S. H. (2016). Issues and challenges in bringing ICT enabled education to rural India. *International Journal of Scientific Research and Education, 4*(1), 4759-4766.

Bulla,C., Hunshal,B., &Mehta,S. (2016). Adoption of cloud computing in education system: a survey. *International Journal of Engineering Science and Computing.*

Buyya, R., Vecchiola, V., & Selvi, S. T. (2013).Mastering cloud computing foundations and applications programming. *Elsevier*

C-DAC Annual Report, 2012-13 (31st March, 2013). Centre for Development of Advance Computing.

C-DAC Annual Report, 2012-13 to 2015-16. Centre for Development of Advance Computing.
C-DAC Annual Report, 2013-14 (31st March, 2014). Centre for Development of Advance Computing.

C-DAC Annual Report, 2015-16 (31st March, 2016). Centre for Development of Advance Computing.

C-DAC Annual Report, 2017-18 (31st March, 2018). Centre for Development of Advance Computing

Charania, A. & Davis, N. E. (2016). A smart partnership integrateing educational technology for underserved children in India. *Educational Technology & Society, 19*(3), 99-109.

Charania, A. (2012-2014). ITE manual. *Mumbai, India: Sir Dorabji Tata Trust.*

Das, R. (2012). Integrating ICT in teaching learning framework in India: initiatives and challenges. *Bhatter College Journal of Multidisciplinary Studies.* ISSN 2249-3301.

Department of School Education and Literacy (2012). National Policy on Information and Communication Technology (ICT) in school education. *Ministry of Human Resources development, Government of India.*

Goswami, C. (2014). Role of technology in Indian Education. *DOI: 10.7763/IPEDR. V79.2*

Kavishwar, A. (2018). Digital education among students in rural areas. *India: Forbes.*

Kitchin, R. (2016). Getting smarter about smart cities: Improving data privacy and data security. *Dublin, Ireland: Data Protection Unit, Department of the Taoiseach.*

Kshetri, N., Fredriksson, T., & Rojas, D,C. (2017). The big data and Cloud computing: Lessons from key industries and economies in the global south. *New York: Routledge Publication*

Kundu, A. & Dey Kedar Nath (2018). Barriers to utilizing ICT in education in India with a special focus on rural areas. *International Journal of Scientific Research and Review, 7*(2), 341-359.

Kuo, A.M.H. (2011).Opportunities and challenges of cloud computing to improve health Care services. *Journal of Medical Internet Research, 13*, 67

Lakshmi, N. Vara (2016). Digital education in India. *International Journal of innovative Research in Information Security, 9*(3), 62-66.

Lone, Z. A. (2017). Technology in education in rural India. *International Journal of Engineering Science and Computing (IJESC), 7*(7), 13953-13955.

Lumde, N. (2018). Between the technophiles and the sceptics: the view from the ground. *Centre for Communication and Development Studies.*

Madangopal, D. & M. (August 6, 2018). ICT in education: the rural challenge. *Centre for Communication and Development Studies,* 1-10.

Manduku, J., Kosgey, A. & Sang, H. (2012). Adoption and use of technology in enhancing management of public secondary schools. *A Survey of Kesses Zone Secondary Schools in Wareng District of Wasin Gishu County, Kenya.*

Margaret, L., Davis, N., Lewin, C., Charania, A., Nordin, H., Orlic, D., Butler, D. & Lopez-Fernadez, O. (2016). Smart partnerships to increase to equity in education. *International Forum of Educational Technology and Society, 19*(3), 84-98.

Mody, A. (2017). India's rural school education report: it's grim all the way, but some states are way behind. *Scroll. January, 2018.*

Murugesan, V., & Bojanova, I. (2016). Encyclopedia of Cloud Computing. *United Kingdom: John Wiley & Sons.*

National Curriculum Framework (NCF) 2005, Retrieved from www.ncert.nic.in/rightside/links/pdf/framework/english/nf2005.pdf

Nisar, M.W., Munir, E. U. & Shafqat, A. (2011). Usage and impact of ICT in education sector: A study of Pakistan. *Australian Journal of Basic Applied Science, 5*(12), 578-583.

Office of educational technological (2017). Reimagining the role of technology in education. *U. S. Department of Education.*

Pardeshi,V.H.(2014). Cloud computing for higher education institutes: Architecture, strategy and recommendations for effective adaptation. Elsevier. *Procedia Economics and Finance, 11,* 589 – 599.

Peeraer, J. & Petergem, P. (2011). ICT in teacher education in an emerging developing Country: Vietnam's Baseline Situation at the start of the year of ICT. *Journal of Computers & Education, 56,* 974-982

Ralhan, B. D. (2017). Five problems with teachers in rural areas which are blocking India's educational growth, *India Today, January 31, 2017.*

Rebecca, W. & Marshall, S. (2012). A new face of education: bring technology into the classroom in the developing world. *Global Economy and Development, Brookings.*

Richardson, J. W. (2011). Challenges of adopting the use of technology in less developed countries: the case of Cambodia. *Comparative Education Review, 55*(1), 8-29.

Salam, S., Zeng, J., Pathan, H. Z., Latif, Z. and Shaheen, A. (2018). Impediment to the integration of ICT in public schools of contemporary societies: A review of literature. *Journal of Information Processing System, 14*(1), 252-269.

Sarkar, S. (2012). The role of information and communication technology (ICT) in higher education for the 21st century. *The Science Probe, 1*(1), 30-40.

Singh, J . (2017).Towards development of an integrated cloud computing adoption framework - A case of Indian school education system. *International Journal of Innovation and Technology Management.*

Tata Trust & IT (2018). ICT implementation in school education in India. *A report by Tata Trust and IT for change. Bengaluru.*

The National Education Policy (NPE). (2009). Retrieved from www.ncert.nic,in/othanoun/npe86.pdf

Twining, P., Davis, N. E., & Charania, A. (2015). Developing new indicators to describe digital technology infrastructure in primary and secondary education. *Montereal, Canada: UNESCO Institute for Statistics.*

Yusuf, M. O. (2015). Information and communication education: Analyzing the Nigerian National Policy for information technology. *International Education Journal, 6*(3), 316-321.