# Advanced Technologies and Tools for Indian Rural School Education System

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## ABSTRACT
Due to lack of attention to few rural schools education, not all rural schools are getting quality education. Some of them are suffering from proper guidelines, right direction in learning and choosing the study and subject materials. It is necessary for rural school education systems to have proper guidelines, direction, quality teaching, subject materials and other. Maintaining experts and quality teaching in every rural school are very difficult; this paper discuss the identified problems of Indian rural education environment. We are proposing advanced technologies and tools which help in fixing the rural education problems. Advanced technologies and tools like i) Virtualization technologies (desktop virtualization and storage virtualization) ii) cloud computing technologies (IaaS and DSaaS) and iii) Moodle (quiz tool and forum tool etc) are discussed along with overview models, implementation flow and its benefits.

## General Terms

Advanced Technologies, E learning, Rural Education;

## Keywords

Advanced Technologies, Cloud Computing, Indian rural school education system, Moodle, Virtualization Technology;

## 1. INTRODUCTION

Villages are the backbones of India. These villages are much dependent on agriculture. In villages, less importance is given to education. To increase the villagers' interest in education, government is facilitating the rural schools by providing many facilities like free food, free books, scholarships and other incentives. Government is also facilitating towards creating/improving a quality education environment. Several researches and studies have taken place for improving village education [1] and to solve the rural education problems [2]. Government has been trying in many ways to develop the rural areas and their education system [3]. Many private communities and government agencies are supporting villages. They are putting sincere effort to provide basic infrastructure and to improve the village living style but some villagers are not able to utilize these facilities. Creation of basic necessities is of prime importance for all of them. Rural life lacks quality food, comfortable shelter, good health, finance, guidelines and general knowledge. Hence, villages are not able to recover completely from poverty, illiteracy and unemployment. Village people are not strong in decision making, problem- solving, mathematical and analytical abilities. One of the main reasons for this situation is, not having the quality and adequate education. Village student needs quality education and guidance towards learning. In this competitive world, books alone are not sufficient to understand the subject matter, gain knowledge and to fulfill their basic education needs. Literally, rural students are quite enthusiastic and hard working in nature. If their efforts are channelized in right direction, then the village growth happens automatically. The experts training, proper guidance, right direction and adequate/expert study materials can improve the rural education. Inturn, these improvements will result in removing the poverty, unemployment and many other ills from rural India. So the basic solutions are: proper and quality education, right direction and suitable guidelines.

The rural schools problems which we discussed above may also be solved by standardization and globalization. Education components for rural schools needs to be standardized with quality and standardized materials should globalize with proper technology. Globalization and standardization materials process should focus on rural education components such as : i) expertise education and quality study materials ii) experts guidance and right direction towards learning iii) sharing the knowledge about recent trends and opportunities iv) exposure of modern world v) proper guidance towards pursuing job oriented courses vi) on demand knowledge. We are proposing some of the advanced technologies and tools to globalize these materials. They are: i) Virtualization technologies ii) Cloud computing technologies and iii) Moodle tools. Virtualization and cloud computing technologies helps in providing on demand education virtually, study materials, libraries, knowledge and guidelines. Moodle helps in interactive learning. Advancement in technologies and tools and its benefits motivates us to look into rural application and to solve some of their problems. These technologies and tools are discussed in the next section of this paper.

The paper is organized in the following manner: In section 2, we brief the latest technologies and tools which help in solving the rural education problems. In Section 3, we discuss the Indian school education system, rural education system environment and its problems. In section 4, we discuss the proposed technologies and tools solutions in rural education system and present the overview models along with the implementation flowchart. We also discuss some of the other technologies which help rural

education. Section 5 will conclude the paper.

## 2. ADVANCED TECHNOLOGIES AND TOOLS

Rural education system needs implementation of e-learning technologies. Rural schools were using the black board to teach particular subject. Later, teaching and training also happens via communication medium like television and radio channels. In the year 2004, Edusat was launched to support education. ISRO launched EDUSAT successfully for presenting the education videos. Currently, due to advancement in internet technologies with respect to speed and high coverage's, advanced internet technologies and tools like Virtualization, Cloud technologies and Moodle can also be implemented in the rural education system where students can get on- demand services at anytime and anywhere. Hence, we are proposing internet- based technologies and tools like Virtualization, Cloud technologies and Moodle tools to the rural school education system. These technologies and tools advancements are beneficial to the society and people in many ways. Following section describes the latest technologies and tools such as, Virtualization, Cloud computing and Moodle which can support Indian rural education system.

### 2.1 Virtualization Technologies

Virtualization is a key technology [7] which provides the virtual desktop, virtual storage area and virtual network. Virtualization supports the mechanism of internet- based access to virtual desktops and storages. Desktop/Hardware and Storage virtualizations are some of the technologies discussed which are necessary in education learning system. Following sections briefly explain about desktop/hardware and storage virtualizations.

#### *Desktop/Hardware Virtualization*

Desktop Virtualization [8] is a technology in integrating multiple cores into a single die. It is the virtualization of computers or operating systems. It hides the physical characteristics of a computing platform from users. It shows the abstract computer environment. In rural educational application, desktop virtualization helps education by providing shared desktop with teaching videos, subject materials, presentation and education software which we have explained in detail in section 4. Fig 3 represents desktop virtualization architecture where two sections exist such as physical and virtual. Physical section refers to the actual hardware and operating system, on top of physical virtual section; it refers to many virtual machines with its own guest operating systems. Second image is the visual presentation of the desktop architecture. Using desktop virtualization technology, we can create the many virtual desktops in a server and makes those virtual desktop available to many rural schools through internet.

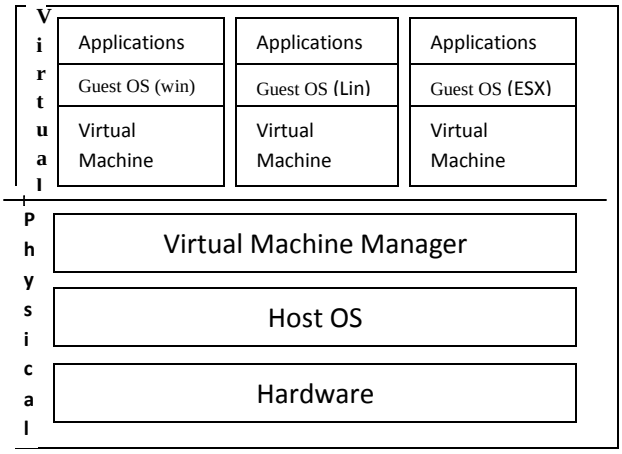


Figure 3: Desktop Virtualization Architecture

#### *Storage virtualization*

Storage Virtualization [9] is a logically separation of physical hard disks and the local storage capacity. It provides a fundamentally better way to manage storage resources for virtual infrastructure. Hence the disk storage complexities are hidden from operating systems. Fig 4 shows the storage area created to serve the rural schools as and when needed for their data sharing. Using storage virtualization, we can create and maintain common library of online videos, useful books and materials to improve the general knowledge, aptitude, analytical, problem- solving and decision making. It is a shared storage area where expert can place useful materials and rural school can access these with proper authentication. We describe more in section 4.

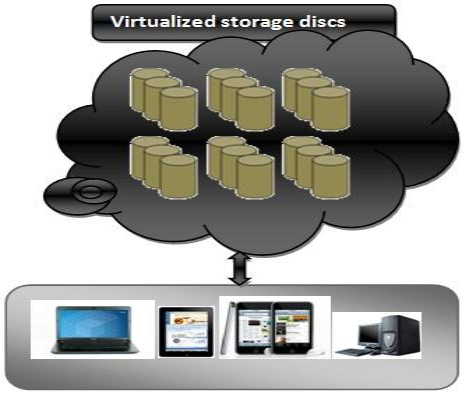


Figure 4: Storage Virtualization

### 2.2 Cloud Computing Technology

Cloud Computing Technology [10] is an on demand, internet based technology. Cloud computing is emerging technology. It provides the software, infrastructure and storage as a service. It offers on-demand internet-based service. It's an internet technology which has created and shared a place among experts

and villages. Expert can place education/knowledge materials and rural schools can utilize them. Two cloud services which support the rural applications are: Infrastructure- as- a service and Data Storage as a service. Infrastructure-as-a-Service supplies virtual hardware resources such as computers, networks, or storage, so that the processed data can be stored in the cloud itself. Infrastructure-as-a-Service refers to a combination of hosting, hardware, provisioning and basic services needed to run a cloud. Data Storage-as-a Service provides huge data storage service to user where user can store huge data backup. DSaaS provides a common storage area between experts and rural schools. Figure 5 shows the cloud IaaS and DSaaS which can be accessed in any rural school campus. We describe the technology usage and benefits in section 4.

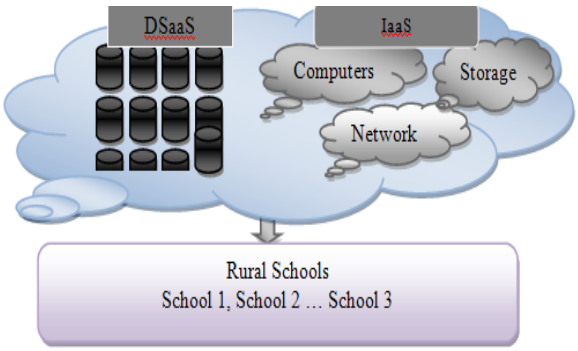


Figure 5: Cloud IaaS and DSaaS at rural schools

## 2.3 Moodle

Moodle [6] stands for Modular Object-Oriented Dynamic Learning Environment. Moodle is a dynamic on-line learning environment. Moodle is a software package for producing Internet-based courses and web sites. Moodle can be used in many types of environments such as in education, training-development and business settings. Moodle is also useful for programmers and education theorists. Moodle provides on-line learning environment. It has features such as: Assignment submission, Discussion forum, Files download, Grading, Moodle instant messages, on-line calendar, on-line news and announcement, on-line quiz and Wiki. Moodle [6] has many tools to enhance students and teachers' experience in a course, such as: Assignments, Chats, Choices, Databases Forums, Glossaries Lessons, Quizzes Resources, SCORM Surveys and Wikis. Fig. 2 shows the screen shot of Moodle software which shows the different tools of Moodle.

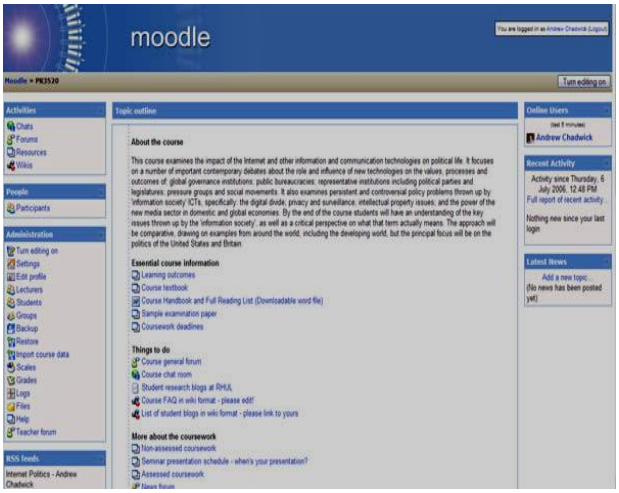


Figure 5: Moodle software screenshots [5]

## 3. INDIAN SCHOOL EDUCATION SYSTEM

In India, government sector and the private sector provide education. Both the union government and the state government control the education in India. Indian education system is divided into different levels such as pre-primary level, primary level, middle school level and high school level education, secondary education. In Indian school education system [11], the National Council of Educational Research and Training (NCERT) is the apex body for curriculum- related matters. The NCERT provides support and technical assistance to a number of schools in India. In India, the various curriculum bodies governing school education system are: The state government boards, in which the majority of Indian children are enrolled; the Central Board of Secondary Education (CBSE) board; the Council for the Indian School Certificate Examinations (ICSE); All these boards have their own standards of education. In rural and urban education, the standards are varying. Following section briefs the rural school education.

## 3.1 Rural School Education System

In India, while condition of some of the rural school [12] is still improving, the financial conditions of these rural schools are not good. There are few schools in rural areas where students have to walk/travel far away distances to avail school facilities. Some of the rural schools do not have proper infrastructure. Rural schools need proper and adequate education facilities. Rural students need direction and guidance in learning. They don't have direction to choose the study, knowledge and subject materials. Rural students are quite enthusiastic and hard working in nature. If efforts are made in right direction, then drastic development can automatically happen in rural areas. We expect, every rural and rural education system should have the following: i) Sufficient number of schools ii) Good transportation facilities to avoid children walking miles to reach the schools. iii) Basic amenities like drinking water and iv) Advanced education v) Computer

education and computer training. vi) Group classes should be taken by using video conferencing and audio conferencing v) The teachers should get facilities with tools like laptops, printers to provide notes and other important notices to the children vi) Better infrastructure as sometimes children are even made to sit on the floor due to non-availability of furniture. vii) Computer aided teaching. vii) Involving rural children in other learning activities like analytical, problem-solving, decision making, sports, co-curricular activities and competitions. Such events and activities tend to help in the overall development of the children. Figure 6 shows the expected rural school infrastructure

Figure 6: (b) Expected rural school infrastructure [5]

Some other identified needs for improving the rural education systems are : i) Quality education and adequate study materials ii) Expert guidance in learning iii) Sharing the knowledge about recent trends and opportunities iv) Exposure of modern world and v) Proper guidance towards pursuing job- oriented courses vi) On-demand knowledge. In [4], reported rural schools problems are: i) Lack of money ii) Lack of infrastructure iii) Ambiguity in selecting the study materials iv) Proper direction towards learning v) Lack of qualified Indians in Indian education vi) Differing expectations of education programs vii) Lack of involvement and control of educational matters viii) Difficulties of students in higher education and viii) Far too many instant-Indian education experts.

## 4. PROPOSED TECHNOLOGIES AND TOOLS FOR INDIAN RURAL DUCATION

We are proposing advanced technologies and tools as solutions to rural schools problems. They are Virtualization technologies, cloud computing technologies and Moodle tools. Following section briefly explain how advanced technologies and tools help in solving the education learning problems and meeting our expectation/necessities which we discussed in the last section.

### 4.1 Virtualization Technologies for Rural Education

This section explains in brief how desktop/hardware and storage virtualization help the rural schools.

#### *4.1.1 Desktop/Hardware Virtualization for School Education*

Desktop/Hardware virtualization can solve money, infrastructure, lack of expertise materials, instant expertise and student's subject material selection ambiguity problems. Figure 7 shows the overview of Desktop/Hardware virtualization at rural school where any school can access the virtual machines over internet. These virtual machines have the school software, study materials, presentation slides and videos etc. Once the study virtual machine is created for students, any school can access those VMs. This achieves the standard, uniqueness, quality in teaching. Rural students can access these virtual machines which has expert teaching materials. It is a shared common machine for teaching where expertise can place the study materials and teacher can play teaching videos and share the study materials with the students.

#### *4.1.2 Storage Virtualization for School Education*

Storage virtualization provides the centralized storage for excellent study material, software, administration information, creative experiments and simulation etc. Figure 7 represents the rural school having the authenticated internet access to centralized storage where expert can place the important data, study materials, knowledge, guidelines, direction, student information and etc. Hence we can achieve standards, uniqueness and quality in education system. It is benefiting schools as: single storage to store experts study materials, to create digital library, to share study materials, to keep track of student administration and education details, and reduced maintenance. At the rural school end, only the projector screen and internet connection are needed to access stored data.

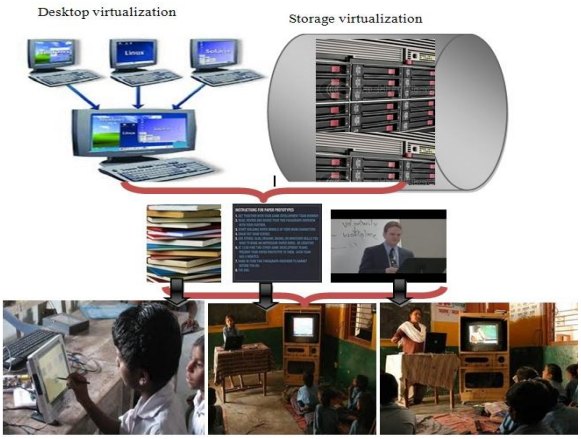


Figure 7: Overview of hardware and storage virtualization for school education [5]

Virtualization installation procedure: Figure 8 represents how we can install virtualization technology in rural education system. First step: Need to install region-wise datacenter, storage area and servers. Second step: Need to create one master virtual machine and storage discs with the subject materials, videos and many?

Third step: Need to create backup master virtual machine. Create many client virtual machines from master VM and make those available to rural schools. At the rural school end, teacher can access these materials via internet and present in front of the students using projector screen. It enables student to learn in short duration, saves teachers preparation time, expand the study scope limits etc.

Implementation flow of virtualization technologies for rural school

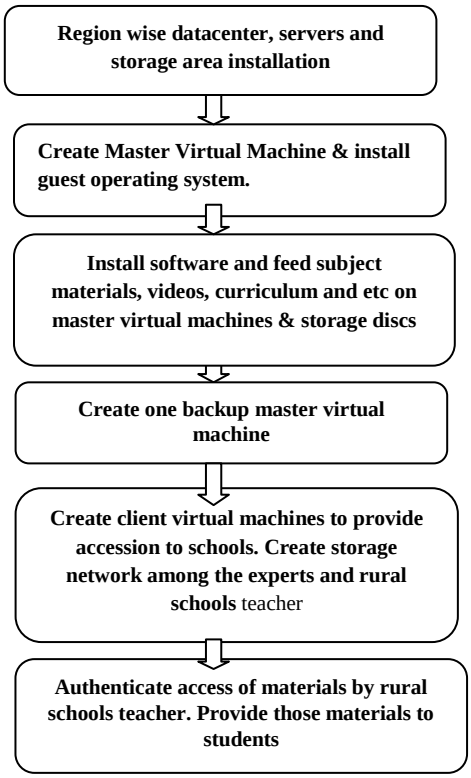


Figure 8: Virtualization for rural education Installation- steps

## 4.2 Cloud Computing Technologies for Rural Education

Virtualization is a foundation for cloud computing technology. This technology provides software, hardware, infrastructure and storage as services. Cloud DSaaS and IaaS are especially suitable for rural application. Data Storage as a Service - A teaching database can be established making modern network of teaching resource and digital library building from where many can learn. The cloud can contain online e-books, teaching materials, directions, courseware and various educational videos etc. Infrastructure as a service: To avail various operating systems environment, network and storages. Many services can be provided by the school clouds system such as: online videos, course material, interactive learning games, online training, presentation etc.


Figure 9: overview model of cloud access

Cloud technology implementation flow for rural school education

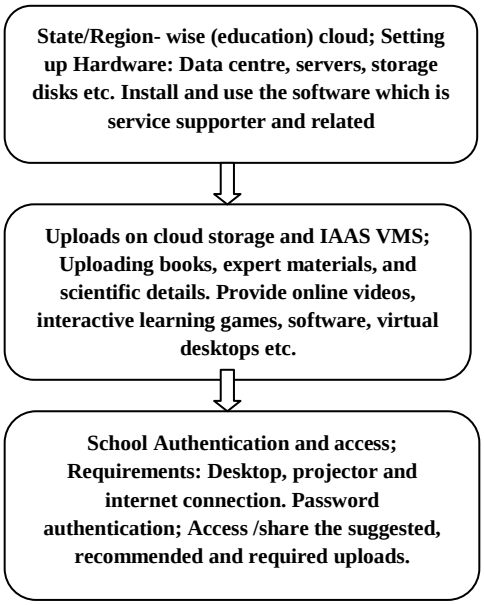


Figure 10: Cloud computing at rural education

Figure 9 shows how the storage and infrastructure can be accessed by rural schools system over internet. Figure 10 shows the flow of installation of cloud for rural school education systems. First step is a creation of storage and infrastructure. Second step is to upload the materials by expert and create infrastructure which are adequate to rural schools. Finally, provide those services to rural schools. At rural school end, teacher can access these services over internet. They can present to the students.

Using above virtualized/cloud computing approach, we can overcome the problems of rural school education system by providing demand Digitized books, expert materials, scientific experiment details, On-line teaching videos, interactive learning games, software, virtual desktops, applications, huge storage etc.

## 4.3 Modular Object Oriented Dynamic Learning Environment (MOODLE) tools for Rural Education

Moodle is a software package for producing Internet-based courses and web sites. It is learning management software. It provides online learning environment. It facilitates the rural students by providing many tools shown in the figure 11.


Figure 11: Moodle screen shots [5]

Tools provided by Moodle are: i) Assignment tool: The assignments can be made available at any time with a start and close date. It is easy for a rural student to upload their work in almost any form. Once the expert has graded the assignment they can send a letter grade and feedback to the student via email. ii) The Chat feature is very useful for rural students as well as expert teachers of a course. A chat space can be made available at all times for the entire class to make comments or ask each other questions, or it can be more specific to a group of students or an assignment iii) The Choice tool can be used to determine the preference of students in reading a certain book or choosing topics for a project. iv) Database tool is great for storing large amounts of information by experts. v) Forum tool is used to share ideas between all rural schools students of a course. vi) Glossary tool is used to help rural students gain a working knowledge of important vocabulary in the course. This can be created and maintained by the expert as a reference point for students, or it can be used as an assignment or collaborative effort for the students. vii) The Quiz tool can be used to assess knowledge before, during and after a unit of study. The quiz feature is great to use before introducing a topic to gauge rural student's knowledge of the content ahead of time, as it is helpful for an expert to adjust their teaching after viewing the results of the quiz. Viii) The Resource tool is designed to allow students to view information that was posted by the expert. Ix) The Wiki tool is designed to allow rural students to collaborate about a topic in a given space. This tool allows all members of a group or class to edit the same "page" about a certain topic. Once the change has been made or content added, all members can see the changes. This again allows for student collaboration with expert supervision and comments available. This is especially helpful when face to face meeting is not probable. X) All of the features can be used in several different ways depending on the nature of the class and those individuals who are learning through the course.

## 4.4 Other Technologies for Rural School Classrooms

There are various types of other technologies currently can use in rural classrooms to access the internet services. Such as i) Class website: An easy way to display your student's work is to create a web page designed for your class. Once a web page is designed, experts can post homework assignments, student work, famous quotes, trivia games, and so much more. ii) Blogs: It allows the students to maintain a running dialogue, such as a journal, thoughts, ideas, and assignments that also provide for student comment and reflection. iii) Wikis are more group- focused to allow multiple members of the group to edit a single document and create a truly collaborative and carefully edited finished product. iv) Wireless classroom microphones: Noisy classrooms are a daily occurrence, and with the help of microphones, students are able to hear their teachers more clearly. The benefit for teachers is that they no longer lose their voice at the end of the day. v) Interactive Whiteboards: An interactive whiteboard that provides touch control of computer applications. These enhance the experience in the classroom by showing anything that can be on a computer screen. This not only aids in visual learning, but it is interactive, so the students can draw, write, or manipulate images on the interactive whiteboard. vi) Online media: Streamed video websites can be utilized to enhance a classroom lesson. Educational technologies are intended to improve education. Some of the claimed benefits are listed below: i) Easy-to-access course materials. Instructors can post the course material or important information on a course website, which means students, can study at a time and location they prefer and can obtain the study material very quickly. ii) Direction to students. iii) Student motivation: Computer-based instruction can give instant feedback to students and explain correct answers. iv) Guidelines in learning v) Wide participation: Learning material can be used for long distance learning and are accessible to a wider audience. vi) Improved student writing v) Analytical, mathematical, problem- solving skills vi) Differentiated Instruction: Educational technology provides the means to focus on active student participation and to present differentiated questioning strategies. vii) Knowledge about the technology, jobs, scopes and opportunities.

## 5. CONCLUSIONS

Indian rural schools' problems may be solved by advanced technologies and tools. Desktop and storage virtualization helps the rural students to get the study, knowledge, subject and learning materials. Clouds computing also help the student to get any learning materials over internet. The Moodle tools helps to rural students in interactive learning and to get proper directions. Other technologies support rural school students in many ways. Advanced tool and technologies provides communication with expert and quality materials. It solves the problems like i) Lack of quality education and less adequate study materials ii)Lack of experts guidance in learning iii) Not sharing the knowledge about recent trends and opportunities iv) Lack of exposure to modern world and v)Lack of proper guidance towards pursuing job-oriented courses vi) Lack of on-demand knowledge etc.

## 6. ACKNOWLEDGMENTS

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