

Technology Enhanced Learning through ICT Tools using Aakash Tablet

Mr. Dasu Vaman Ravi Prasad

Associate Professor, Anurag Group of Institutions, Ghatkesar,
Ranga Reddy District, Hyderabad-88, Andhra Pradesh, India.

Abstract. :- Today with advancement in technology teachers have been conscious about the quality of teaching. Teaching can be enhanced through information communication technology (ICT) tools in education system for better understanding of the subject. Information communication technology can be utilized for the education sector. ICT can play great role in formal and non-formal forms of education. Lots of companies are coming up with digital materials for poor students. Many are making specialized hardware to meet the requirement of elementary education system.

Keywords: *ICT, gadgets, technology, traditional, Education*

I. Introduction

“Students cannot be effective in tomorrow’s world, if they are trained in yesterday’s skills.” -Tony Blair.

Education is a process by which a person’s body mind and character are formed and strengthened, which enables a person’s holistic development of personality through knowledge. This knowledge can be improved by the students through their learning environments. Nowadays Information communication technology (ICT) tools are widely used to interact in digital environments [1]. ICT brings more rich material in the classrooms for the teachers and students. With the help of ICT, students can easily browse via sample examination papers, e-books, assignments, videos etc. and can also have an easy access to mentors, experts, resource persons, researchers, professionals all over the world.

IT has become a buzzword while talking about technology and its applications. IT is used in various business and management functions but not in the improving the quality of education. Quality of education has been issue of concern in the absence of standard parameters of to measure the quality. The hardware, software, the methods and know how required or used in acquiring, storing, processing and displaying data and information is collectively known as Information Technology (IT). Also on other hand, many developments and achievements took place in communication technology sector after and Second World War. Hardware, know how, programs and the methods used in ensuring that message is transmitted correctly, efficiently and cost effectively are collectively known as Communication Technology (CT). Both of these technologies became complementary to each other means progress in one alone is not much beneficial. Hence IT and CT started moving together and a new term was coined named as Information and communication Technology (ICT) [8].

Convergence of these two technologies gave birth to ICT. Education system includes formal and Non-formal forms of education at various levels of education. Teaching is imparting knowledge or skill whereas learning is skill

acquisition and increased fluency. Usage of ICT is one of the way by which India’s large population base can be effectively reached. Moreover in enhancing the quality and delivery of services through ICT especially in case of developing relations with citizen-Government will be better positioned. Passive learning occurs when students use their senses to take in information from a lecture, reading assignment, or audiovisual. Traditional lecture is not an effective learning environment for many of our students because so many students do not participate actively during a traditional lecture [5]. This is the mode of learning most commonly present in classrooms whereas active learning involves the student through participation and investment of energy in all three phases of the learning process [4]. This type of learning is more apt to stimulate higher cognitive processes and critical thinking. In the past few years there has been a paradigm shift in curriculum where teacher acts as a facilitator in a student centred learning. In Student centred learning focus is on the student’s needs, abilities, interests, and learning styles with the teacher as a facilitator of learning. Here students have to be active responsible participants in learning process. Teacher has key role in the whole process whereas in case of ICT based education [7], various ICT tools are supplemented to make the teaching-learning process effective. With the help of blended learning, total time devoted to teaching can be decreased. A survey says that there was a sense of pride created and interest generated among the teachers and students for gaining ICT and its privileges. ICT has the potential to remove the barriers that are causing the problems of low rate of education in any country. ICT as a tool can overcome the issues of cost, less number of teachers, and poor quality of education as well as to overcome time and distance barriers. In this paper how learning through ICT can be made effective and easier for improving the quality of both formal and non-formal forms of education.

II. Traditional Learning

Advantages of Traditional Learning

Teaching in a traditional schoolroom is vastly different from facilitating a virtual classroom. Classroom environments promote and stimulate a dynamic known as

collaborative learning. Collaborative learning translates into a type of learning in which the pairing or grouping of students is required to complete a task or to come to a specific outcome. Teaching in a classroom gives students the opportunity to engage in live discussions in which they are forced to use their critical thinking skills to formulate opinions or arguments. When students are placed in a live classroom, they experience social interactions with peers and establish rapport with teachers. Helping children develop socially is an important aspect within the realm of their academic education. Classroom teaching environments help students figure out how to resolve conflicts, work in teams, get along with those from different cultural backgrounds and give presentations in front of peers. Such experiences are valuable in shaping students' communication and listening skills, as well as growing and maturing emotionally.

Teaching in a classroom environment opens up opportunities for teachers to do more with their lesson plans [6]. Traditional classroom settings teach students how to develop organizational skills, beginning with the basics, such as arriving to school on time. In a live classroom, students are held accountable for being prepared to do school work, which includes having done their homework the night before, being ready for pop quizzes, turning in assignments by their due date and being prepared for in-class discussions.

Disadvantages of Traditional classroom teaching

A drawback of traditional training is that it inherently places the most value on standards, curriculum and passing tests as opposed to student-focused learning. Student-focused learning places value on the student and builds the curriculum around the questions young people need answered in order to understand the material. Constructivist learning builds on the knowledge students already have allowing them to form concrete associations to new information, which improves retention. Traditional learning is based on repetition and memorization of facts that students care less about and retain at lower rates after testing. Traditional classroom training doesn't encourage critical thinking skills, the ability to actively apply information gained through experience and reasoning. Instead, traditional training emphasizes the role of teachers as knowledge

dispensers and students as repositories. This style of learning doesn't allow students' deeper levels of understanding required for complex concepts and lifelong learning. Traditional training emphasizes passing tests, whether or not students understand testing material. The learning process is thus devalued, and students are not encouraged to understand the methods, techniques and skills required to find answers. Traditional training emphasizes individual student work and projects and is poor preparation for a student's future endeavours, which are likely to include working on teams and collaborating with colleagues. Under this training model, students receive few opportunities to practice group dynamics and teamwork [7].

III. ICT application for quality improvement in formal and non-formal education

ICT applications are becoming indispensable parts of contemporary culture, spreading across the globe through traditional and vocational education. In Indian scenario, mainly education system has three tiers primary, High school or secondary level and the college or higher level. In all these levels of education ICT can be utilized for better teaching learning process and improving quality of education. Using multimedia in education results in the increasing productivity and retention rates,

because people remember 20% of what they see, 40% of what they see and hear, but about 75% of what they see and hear and do simultaneously. Interactive whiteboard helps teachers to structure their lessons, supports collaborative learning, can help to develop student's cognitive skills, enables ICT use to be more integrated into classroom. Government of India has announced 2010-2020 as decade of innovation [8]. Reasoning and critical thinking skills are necessary for innovation. Foundation of these skills can be laid only at primary level of education. Students who enter school are very curious, creative, and capable of learning many things. At this level, statement Picture is worth than thousand of words is very much true in case of teaching – learning process. Befriending ICT in the initial stages of education will help young people come to terms with what lies ahead. Students studying at this level take much interest in cartoons. They understand more through animated pictures. Hence if the same environment is created in schools by using ICT for teaching kids at primary level may bring drastic changes in the education scenario. Nursery students can be taught by showing pictures, animals, fruits etc. With the help of ICT tools students at this level are able to grasp a lot by hearing voices or sounds and animated motion of various animals. Language learning is also taught at this level [9]. To know a new language at this age is easier as compared to other levels. Multimedia projector & computer can be used to teach phonetics and pronunciation. Lessons, poems & lectures by eminent scholars stored in computers or other ICT tools can easily be shown to the students time and again anywhere. Such type of teaching and learning retains for longtime in the minds of the children. At high school level subjects like History, Geography, Political science, Physics, Chemistry, Biology, Physical education etc are taught. Lessons in these subjects can easily be taught by showing small movie related with the subject to create interest among the students. Such type of movies and related multimedia material is easily available at academic repositories and from various related sites with the help of Internet. Internet is basic tool which can be utilized by teachers and students to find any information on any topic. This type teaching-learning makes the environment very interactive and is liked by students. Educational and practical CD's available in the market make this task easier to implement. At college level various facilities like computers, Electronic Board, Edusat facility initiated by various state Governments, MM projector and other peripheral devices related with teaching learning process are easily available. Easy availability of Aakash

tablet will help in providing and getting more education for both teachers and students. Repositories are libraries where these digital resources are stored and provide teachers, students, and parents with information that is structured and organized to facilitate the finding and use of learning materials regardless of their source location. Various programs running on Edusat are also very helpful for the students. Soft skill program can help students in getting their placements in reputed Multi National Companies (MNCs). State level quiz and seminar can also be conducted with the help of Edusat infrastructure and can be transmitted throughout all institutes. Edusat can be used for providing training to teachers on the latest subjects and technologies and can save lot of time and money of governments. In Haryana Edusat project is being implemented at school and college level and is being used for transmitting lectures according to syllabi. In Non-formal learning, learners can access information and learning materials from anywhere and at any time. It includes distance education and other open learning systems. There are various functions to be performed with the enrolment of students in any course of distance education in any University or institute [9]. Functions include allotment of unique number, providing books, providing information related with instalment of fees and details thereof to name a few. Out of all these activities some of these may be performed well with the help of ICT Tools. In the distance education ICT can be used for better management of records by making a complete database of all the students in various courses. Once the students are enrolled, a unique number is generated called reference number and it is provided to the particular students. Short Message Service (SMS) of Mobile phone may be utilized for this purpose. Mobile phone is one major ICT tool and can be used for the purpose. Other information related the PCP, Exam dates can easily be sent to the students through SMS by Universities/Institutes concerned. Moreover the enrolled students can be given username and password for using various online services and resources in the form of academic repositories maintained by institutes. All such instructional material may be uploaded at the University portal and CDs of those lectures may be provided to the students instead of printed or hard copy material. Online fees payment system can also be made on the portal of concerned University or Institute. Students will be saved from a lot of hardships they face in depositing fees, attending PCPs, taking exams and many more. Exam results in such cases may be provided online on the same day as same is happening in case of online exams and entrance tests. This would help to sort out the problem of the delay in declaration of results of various exams by various universities. But all this must be the case for the Non-formal education system. Advantages of utilizing such tools include saving of lot of paper [7].

IV. IT Enabled Classrooms

Keeping in view the above advantages and disadvantages of traditional classroom teaching, where usually a lecture method is followed, in case of higher education. We can add some IT gadgets to the classroom [3]. Projectors are already being used in classrooms for teaching.

No doubt that this (projector) is an excellent IT gadget used in classroom, but our teachers as well as students failed to make optimum use and it is being used as a presentation tool only. With the passage of time many new gadgets are coming up to a classroom which includes laptops, Netbooks, smart phones and tablets. All these devices can be used in classroom for teaching purpose if planned properly. We had to set up the following infrastructure to set up a IT enabled classroom to teach some IT related subjects. A classroom with the capacity of 30 students was selected with following IT Gadgets

- 1 Standard Computer with Speakers
- 1 Multimedia Projector
- 1 Wi-Fi Router.

Following are some more electronic gadgets proposed to be used in class.

3.1.1 Laptops

Laptop is the need of any engineering student. This is used by student to keep the records of all his notes and as internet is available in almost of the campus, students use Internet to complete their assignments. There are many eBooks available free of cost, students download such eBooks and study using laptops.

3.1.2 Netbooks

Netbooks are smaller laptops, usually 10" to 12" display with reasonable processor, memory and disk space can be used as laptops. This is the second type of electronic device preferred by students due to its cost, size and battery life.

3.1.3 Mobile Phones

Mobile Phones are usually not recommended in classroom and in most of the classrooms mobile phones are banned. But if monitored properly smart phones can be used a learning tool.

3.1.4 Tablet

Tablets are gaining popularity and with the regular advancement in technology the prices of such devices are coming down. Tablets are available in the price range of Rs 4000. Government has taken initiative by introducing Aakash tablet that perfectly suits the pocket of undergraduate students. One common feature that is required is Wi-Fi and almost all the tablets have inbuilt Wi-Fi adapter so that they can communicate over local area network [2].



Fig. 1. Aakash 2.0 tablet

3.1.4.1 About Aakash 2.0 tablet

Aakash 2.0 is a complete educational purpose tablet and not designed with hi-fi configurations. Aakash 2.0 includes 3D-modelling, C++ programming, remote and collaborative training applications, robotic control and live assessment tools. IIT Bombay has partnered with the Center for Development of Advanced Computing (C-DAC), to assist with the hardware testing and logistics.

3.1.4.2. Aakash Applications

The tablet comes with variety of applications. A sample set of applications is shown below.



Fig. 2. Sample page of applications

The tablet also includes Mango learning solutions for game-based educational modules, interactive smart books and the full CBSE curriculum and assessment tools. Intelligia finger tracing apps have also been included to teach letter writing to toddlers. Some of the salient applications are highlighted below.

a. Blender: Blender is a free and Open Source software product, used for creating animations, rendering, video editing, etc.

b. Clicker: Clicker devices are used to collect instant feedback from a large number of students, either as a response to a question, or to a quiz. A quiz question now gets fully downloaded on individual student's Aakash tablet, through Wi-Fi. A multiple question test can now be conducted. All the questions of such a test are downloaded on the student tablet. Time control is maintained by Aakash. At the end of the test time, all answers are automatically collected, and individual scores get recorded in the back-end system.

c. Content Distribution: Apart from displaying text files in various formats, Aakash can play video and audio content. A lot of content is available through projects such as NPTEL, Spoken Tutorials, Teachers' Training Workshops, etc. Additionally, Wikipedia, Gutenberg project, Connexions project at Rice University, and many such global efforts have generated a large pool of knowledge content in Open Source. The contents can be kept in the tablet or they can be accessed.

d. proximity : proxyMITY enables creation of interactive lessons, by importing lecture video and presentation slides. The name stands for Proxy Multimedia Integration Tool for You. The entire lesson can be published in the form of either a desktop standalone application, or as html content to be viewed within a web browser.

e. Robot: The project aims at design and deployment of robots, for enhanced teaching of subjects in Engineering Colleges and to Create Open Courseware for Embedded Systems for engineering students, based on robots. A Robot-control application runs on Aakash. Students can control the movement of the Robot using a simulated touch-controlled joy-stick provided on the tablet. Simultaneously, the video stream captured by the camera mounted on the Robot, is transmitted to Aakash, which can be viewed in a window on the tablet.

3.1.4.3 Tools and Languages

Aakash tablets support C, C++, and Python for programming activities. Also, SciLab is available for numerical computations and for research activities.

3.1.4.4 Purpose and Usage

IIT Bombay has planned to deploy the Aakash tablets in engineering institutions in India, with two objectives.

- The first is to test and enhance the effectiveness of these tablets for use in class rooms.
- The second is, development of new educational applications and contents on Aakash, largely through final year Research and Development projects done by BE/ME students at institutes.

3.1.4.5. Ebook Readers

Ebook readers are small tablet like devices, which can display the content of eBook and can also be used to keep notes. Kindle from Amazon is the most popular eBook reader. Ebook readers also come with Wi-Fi Connectivity.

3.2. Setting up a IT enabled Classroom: Our college has set up the following infrastructure to set up a IT enabled classroom to teach some IT related subjects. A classroom with the capacity of 30 students was selected with following IT Gadgets [3]:-

- 1 Standard Computer with Speakers
- 1 Multimedia Projector
- 1 Wi-Fi Router that can support up to 30 wireless connections
- We installed Linux Mint 13 (Cinamonn 64 bit) and configured with following softwares/services.
- Apache2 (Web Server)

- Squid Proxy server
- Samba (file server)
- MySQL (Database Server)
- phpmyadmin
- LibreOffice
- Moodle (Learning Management System)
- Aptana3 Studio (IDE for programming)
- JDK
- Java Netbeans

This Computer system was connected to Wi-Fi router and projector. And we were ready with our IT enabled classroom, where teacher can teach with the help of presentations and can also demonstrate examples by running them on this computer. We selected those 30 students for our class who were having either of such electronic gadgets. Students were asked to bring their devices to classroom and first day with the help of IT technicians and lab-attendants. All devices are configuring to use classroom Wi-Fi so that they can access the resources stored on our classroom server. Though there were more than 30 students having such devices, we had to select only 30 so that we can conduct the trial, we decided to select those students who were considered to be weak in class.

V. Proposed System Architecture

Proposed features of the system

As stated in the earlier chapters, the project aims at producing a cross-platform in-class teaching and classroom management system that can serve both as a whiteboard and a notebook. According to it, some of the important features of the proposed system are described below.

4.1.1 Registration and session management for teachers and students

The system should keep the record of all the teachers, students and courses. Hence, it should allow registration of teachers and students and enrollment of students in different courses. In running state, the system should keep track of the present students at any point of time. For this, the system needs to maintain up-to-date session information for both teachers and students. Also, the system should automatically record the attendance of any student who logs in and enters a particular course so as to reduce teacher's burden of taking attendance. The system should make sure that no student registers himself more than once in a single lecture. The system should enable any student to check his attendance in any course. It should allow teachers to check the attendance of all the students enrolled in any particular course, so that he can inform the students having less attendance than expected.

4.1.2 Teaching and note taking

This is the most important feature of the proposed system. It should present every teacher and student with an interface having features of basic drawing using stylus pen on a tablet PC. The system should also enable them to change the color and line width of drawing as they may

want to highlight something. As the teacher starts teaching (solving a problem) on his tablet (instead of whiteboard), teacher's screen should be transmitted live to all the present students. Now all the students should be able to see the problem being solved on their own screens instead of the whiteboard. Moreover, they should be able to make their own notes on top of the live feed that they receive from the teacher. In that way, teacher won't have to keep standing for the whole duration of a lecture, students won't have to switch their eyes from whiteboard to their notebooks and they will have better organized class notes. After a page gets full, users should be able to save it as a file for future and a new blank page should appear. Users should also be able to load a previously saved page, if they want to solve or change an earlier solved problem.

4.1.3 Monitoring

In real world classes, many times a teacher gives the students a problem to solve. Students solve it and the teacher walks across the classroom to track the progress of any student he wants. In an effective teaching system, this should be automated. The teacher should be able to switch the mode from *Teach* to *Monitor*. In the monitor mode, the teacher should be presented with a list of all the students present in the class at that point of time. After the teacher enters the user id of the student he wants to monitor, the screen of that student should be visible on the tablet of teacher. This will reduce the teacher's efforts in tracking the progress of every single student.

4.1.4 Sharing

This is another important feature of the proposed system. In real classes, teacher sometimes asks a student to solve a problem on the whiteboard. This should also be automated. In the proposed system, the teacher should be able to switch the mode to *Share*. After switching the mode, the teacher should again be presented with a list of students present in the class. After the teacher enters the user id of a student, the screen of that student should be visible on the tablets of all the students as well as the teacher. The difference between monitor mode and share mode is that in the former, only teacher can view the selected student's screen while in the latter, every present member of the class can view it.

4.2. System Structure

The system is based on the simple client-server architecture. There is a central server on which the entire program and database are kept. Teacher and each student have a tablet. There are 10 different clients for teacher and student. Clients are able to connect to the server via a wireless network set up in the classroom. The system structure is shown in figure 4.1

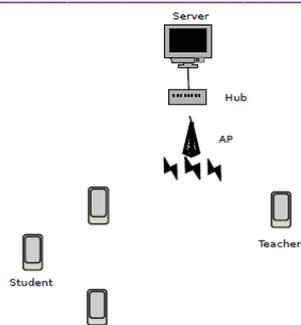


Fig. 3. System Structure

4.2.1 Client-server communication

- There are different messages exchanged between clients and server over the period of a lecture. These messages are as follows.
- At the beginning of a lecture, clients log in to the server. At this time, clients send their authentication information, i.e. username and password. After authenticating the clients, server sends them their respective home pages.
- Clients send the id of the course that they want to enter to the server. The server, after verifying the course id, sends them the current page of that course.
- In *Teach* mode, teacher continuously (e.g. once in every 500 ms) sends the teaching data to the server, which is then sent to all the students by the server.
- As soon as a student enters a course, he continuously (e.g. once in every 500 ms) sends a request to the server to know the current mode of teaching. The server queries the database and sends the current mode (i.e. *Teach*, *Monitor* or *Share*)
- When the teacher switches to *Monitor* mode, the teacher stops sending teaching data, instead the selected student sends data (his screen) to the server and the server then sends it to the teacher.
- When the teacher switches to *Share* mode, the selected student sends data (i.e. his screen) to the server which the server then sends to all the other connected clients.
- At the end of the lecture, the entire clients log out of the server and the communication terminates.

4.2.2 Observations

During the 1 hour session the first part was usually silent but in self practice period there was lot of noise due to peer to peer discussions and teacher had to announce to keep the noise pollution under control. Secondly in case there are common doubts it was difficult for teacher to go to each individual and address their doubt. A kind of indiscipline was observed in classroom during session and for this reason only we had to employ more than one teacher [1]. During some sessions we felt that organizing such type of classes is not feasible because, there was an expenditure of over 1 lakh per classroom (that includes the cost of computer, Wi-Fi router, projector and other installations).

Also there are many students who are financially weak and cannot afford expensive electronic gadget for such classes. The initiative by IIT Bombay in this regard is worth mentioning here as they are trying to develop low cost Aakash tablet which can be used in this process. It was observed that there was a remarkable improvement in the performance of students as those who were literally bottom liners (used to pass with grace, sometimes) successfully passed the test, off course not with flying colors, but with reasonable score. But this was restricted to those students who participated actively in self learning sessions and vigorously surfed Internet and our local resource repository for information and studied it[4]. There were some students who were more interested in copying the content only, we could control this by motivating students to solve the assignment during class only and helping them doing so.

VI. Conclusion

This paper has sought to explore the role of ICT in education as we progress into the 21st century. Taking the trends discussed in this paper into account it can clearly be seen that the education system should change to adapt to modern requirements and to incorporate new technologies [7]. By incorporating these technological trends into the educational system a higher quality education can be provided at a cheaper cost and spread over a larger segment of the population. Children are required to apply their ICT know-how in other lessons, but little emphasis has been placed on how they are taught ICT. This paper discusses the current teaching practices and techniques used in teaching and learning process. Today we need to create a perfect balance between quantity and quality of education. We cannot expect educational authorities to cut down the syllabus so that student learns only, what he can understand, at the same time we need to make sure that whatever is being taught, must also be understood. The proposed technique of teaching with the help of ICT will surely increase the learning level of the student but we might end up in a situation where we could cover only half of the syllabus [6]. Secondly setting up such infrastructure involves lot of expenditure on hardware (IT devices) as well as manpower, because we need to employ multiple people in a classroom. This approach might seem infeasible in some situation, but still we cannot deny the output. Students learned better and shown remarkable improvement in their understanding. Leaving aside the financial aspect, we recommend that educational institutes must set up few IT Enabled classroom if they really want their students to be ready for competitive world ahead. Increased student satisfaction can lead to both increased faculty satisfaction and higher student retention [5].

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BIOGRAPHY

Mr. Dasu Vaman Ravi Prasad working in Anurag Group of Institutions as Associate Professor in Dept.of. CSE, having more than 15 years of experience and areas of interest are Artificial Intelligence, Machine Learning, Image Processing and Parallel Computing.