

Digitising the Black Board:

How Indian Schools should integrate Information Technology in Education

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"A veteran fifth standard teacher opened her first week of classes in November with the usual topic —bugs—but her application of digital tools and content made this years' exploration of the insect world anything but ordinary. With the help of the Internet, students embarked on a virtual field trip to a Natural

History Museum three thousand miles away.

After touring exhibits, students interviewed experts and curators and questioned

conferencing. As teams to study students broke into specific species, the teacher guided and managed their individual research and learning plans.



One group of students narrowed their investigation to ants. Unlike the hundreds of the teacher's students over the years, who simply drew pictures to memorize ant anatomy, these students used an animation simulator. With this tool, the students created a three-dimensional moving ant model. When they forgot to include all the limbs, their creation hobbled jerkily. This humorously rein-forced basic facts about movement and structure. The students built and organized their findings into a database. This gave a baseline to compare and analyze their findings against those from other parts of the world".¹

¹ "The Power of Digital Learning: Integrating Digital Content," Ceo Forum on Education & Technology, June 2000 (www.ceoforum.org)

Transforming Traditional Learning

A fifth standard teacher used digital tools to make an age-old topic interactive, collaborative and engaging for students. What we are seeing is a shift from the traditional learning environment to a new learning environment where technology plays a vital role in enabling students to explore, experiment and create collectively.

Traditional learning has always been a one-way information exchange, where teachers deliver lessons through lectures, textbooks and blackboards. The teacher plans, guides and delivers knowledge, which may

	Traditional Learning Environment	New Learning Environment
Environment	Instruction	Construction
Classroom Activity	Teacher centered	Learner Centered
Teachers Role	Expert	Sometimes Learner
Students Role	Listener	Collaborator
Content	Dated, Static, Textual	Current, Online, Multimedia
Instructional Emphasis	Factual Knowledge Based	Critical Thinking: Inquiry & Invention
	Information Delivery	Information Exchange
	Passive Learning	Active/exploratory learning
	Single Sense Stimulation	Multisensory Stimulation
	Isolated work	Collaborative work
Concept of Knowledge	Accumulation of Facts	Transformation of Facts
Demonstration of Success	Quantity	Quality of Understanding
Technology Use	Drill & Practice	Communication, Expression, Collaboration, Information

Source: "Professional Development: A Link to Better Learning," Ceo Forum on Education & Technology, February 1999 (www.ceoforum.org)

be static and dated. Students have to absorb and process the information passively, through memorization of facts.

Most of us recall hours spent memorizing textbook formulae and less spent hands-on, on the field.

The formal Indian school system despite its high quality content

lacks severely in its ability to make learning a dynamic process. Indian educators limit the use of technology to teaching students basic computing skills, rather than going a step further and employing technology to enhance the learning process. A large majority of Indian schools use standard teaching methods that support and reinforce the traditional learning environment. This method of learning relates achievement to the quantity of knowledge students accumulate; not necessarily the quality of their understanding, which translates into real-world application.

On the other hand, the new learning environment focuses efforts on providing students with the skills to analyze, innovate, collaborate and apply. A two-way information exchange allows education to be an interactive and communicative process. Technological tools- multimedia, simulation, project-based problem solving allows students to use all their senses to absorb and disseminate real-world information.

Not only do students become digitally literate, they learn teamwork, self-direction and inventive thinking that are critical to their development.

World over, technology has become an integral and indispensable tool of communication, organization and information exchange in our homes and offices. Schools however, have been slow in harnessing the full potential of technology, which is a necessary driver of interactive learning.

The Evolutionary Pathway

Enhancing the learning environment through use of technology cannot be achieved instantaneously. The journey from when a teacher uses the computer to type a question paper, e-mail homework assignments, to

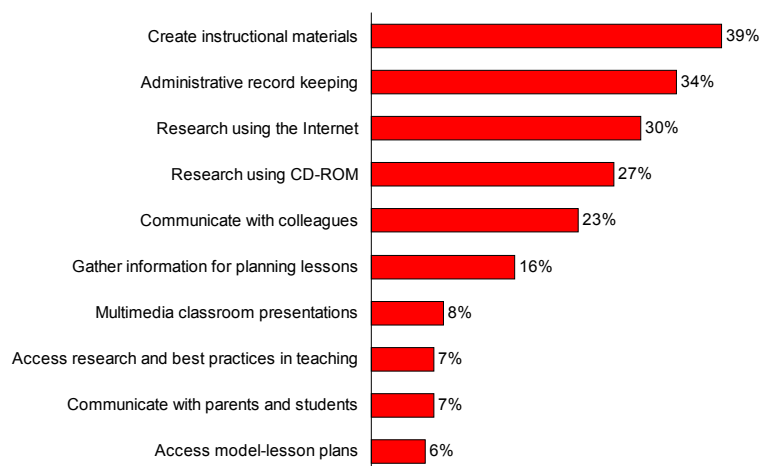
Stages			
I Early Tech	II Develop Tech	III Advanced Tech	IV Target Tech
Application			
Reinforce basic skills	Refer to CD ROM encyclopaedias and Internet for research	Use digital tools for problem solving and classroom teaching, integrated with lessons	Use technology in all subjects, across all age groups and learning becomes student centered, and project based
Infrastructure			
Internet/ Computers are rare	Have Internet and Networked Computers	Broadband connections/ scanners	Range of digital tools: video cams, voice mail...
Student: Computer Ratio 10:01	Student: Computer Ratio 10 to 5:1	Student: Computer Ratio 5 and less:1	Student: Computer Ratio 3 to 1: 1
Training			
Training Budget > 5% of Technology Budget	Training Budget > 10% of Technology Budget	Training Budget > 15% of Technology Budget	Training Budget > 30% of Technology Budget

the time she takes her students on a virtual online tour through a Museum is a gradual one, that depends not only on the resources available to her, but her ability to integrate the resources into classroom lessons.

Source: T. Michael Nevens, "Fast Lines at Digital High," *The McKinsey Quarterly* 2001, Number 1

A McKinsey study states that schools usually go through a process of evolution before they maximize the benefits from technology. Based on usage of hardware and connectivity, professional development and the use of software and Internet in teaching, schools are classified into four stages, Early Tech, Developing Tech,

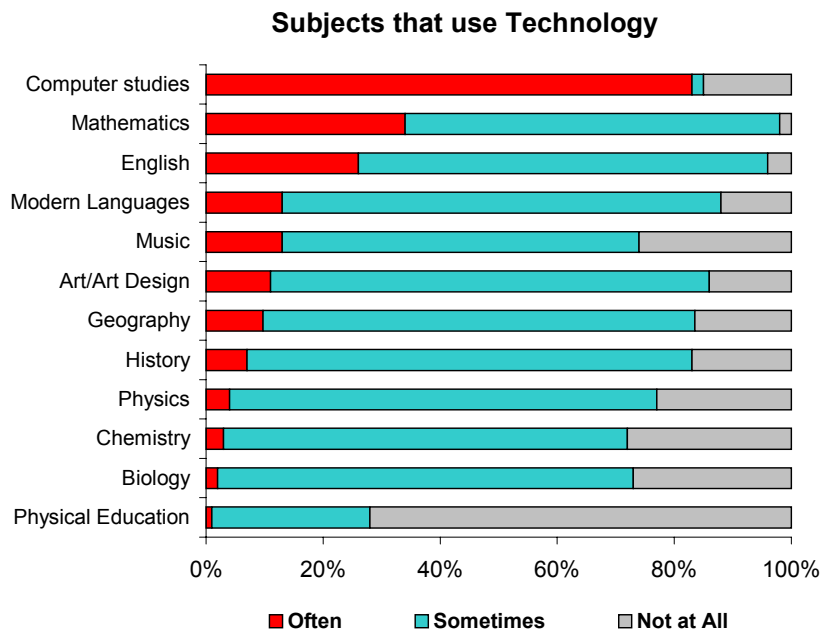
Teachers' use of computers/Internet



Source: "The Power of Digital Learning: Integrating Digital Content," *Ceo Forum on Education & Technology*, June 2000 (www.ceoforum.org)

Advanced Tech, and Target Tech. As of 1998, more than 75% schools in the US were in the stage I & II.²

Across the stages of evolution, the level of technology usage differs across subjects and age groups. A study done in the early 1990s in U.K. found that technology contributed the most to learning in mathematics, primary level English and secondary level geography. The extent of technology use in learning varies for each subject, depending on the nature of the material and availability of relevant software and information.



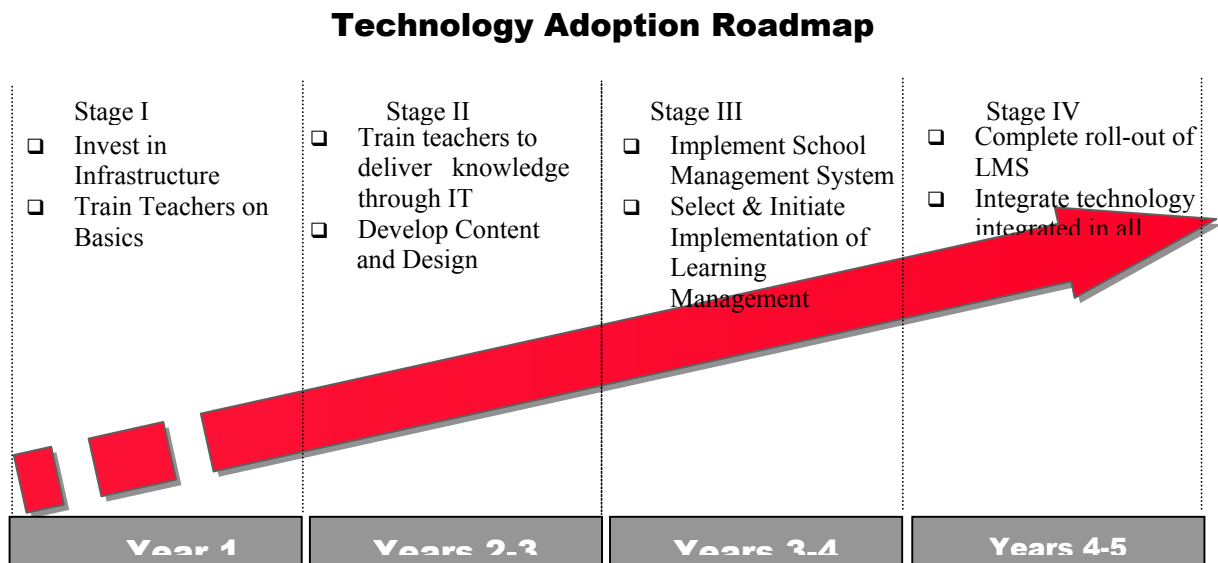
Source: “IT in UK Schools – Its time for a Strategy” The Mckinsey Quarterly 1997, Number 2

Technology users have also recorded direct benefits in academic performance. The U.S. Educational Testing Service conducted research on the impact of technology in an eight-standard math classroom. They discovered that when well-trained teachers used computers to apply thinking concepts in math, student grades improved by one third.

² T. Michael Nevens, “Fast Lines at Digital High,” The McKinsey Quarterly 2001 Number 1

How should Indian Schools use IT

There are a handful of Indian schools that are moving towards achieving benefits from technology-enabled learning. Majority of educators, though aware of the shift to new learning environments, don't know how or where to begin. To effectively integrate technology in their schools, educators need a roadmap for technology adoption that meets the educational objectives of the institution. This is set out below:



Source: UC Analysis

A successful technology adoption plan must have well defined objectives and achievable and measurable targets. That means, before a school decides to integrate technology, it needs to set clearly defined educational objectives and assess its current capabilities and resources. Most importantly, its rate of adoption must be in synch with its objectives, resources and capabilities. Once the stakeholders, administrators, teachers, and parents have a complete understanding of what they intend to achieve through the use of technology, they need to design a technology adoption plan that is aligned with the school's objectives and educational goals. The adoption of technology cannot be a one time effort or investment. A school must adopt continuous improvement strategies, reassess their objectives and adapt their IT plan

accordingly. However, most Indian schools are in a nascent stage of technology adoption and will follow a similar path and experience similar hurdles.

The First Stage:

Usually, the first stage of adoption should focus on investment in hardware and training the teachers on basic uses of technology. The greatest infrastructure will be of little use if the educators don't know how to use it effectively. It is important to allow teachers to get comfortable with using computers for administrative purposes, the internet to find information and e-mail to communicate. Training courses should be customized to the teacher's level of technology friendliness. Training can be in-house or outsourced based on a school's internal capabilities.

The Second Stage:

Once teachers are more familiar with using technology for basic functions, the focus should be on training teachers to use technology to deliver knowledge in and out of the classroom. Great infrastructure and

“Professional Development is perhaps one of the most critical elements of any successful school technology integration program”

trained teachers cannot teach effectively if they don't have relevant subject specific digital content i.e. music, videos, multimedia, animation, simulation games, interactive CD's etc. Initially the school must focus on finding

readymade software. Currently, companies developing readily available software tailored to meet the requirements of the Indian Education Boards are in their infancy, and limited to few age groups or subjects. A school should define a content development team that will identify, evaluate, procure and organize new content. Teachers should not be expected to develop their own content, unless they are extremely comfortable with technology or take the initiative to do so themselves. The planned curriculum should be flexible and experimental, ensuring that a teacher's initiative and creativity is the prime force for use of

technology. Apart from creating content, schools could also host a website through which teachers, administrators, students and parents, exchange information and communicate over e-mail.

The Third and Fourth Stages:

In the third stage a school should select and initiate implementation of a School Management and a Learning Management System. A Learning Management System enables organizations to deliver, track and manage multiple forms of training from one central system. School Management Systems allow for collection of school information, automated assessment and performance evaluation, generation of report cards, class schedules, alumni tracking and email communication.

In the final stages, teachers' will be confidently using digital content in new and engaging ways that will transform the learning environment. Administrators will be able to maximize productivity and parents will be able to participate in their child's development. Eventually, technology will become an essential learning tool for students, teachers, administrators and parents. By our estimate, if implemented properly, it would take an average of 4 – 5 years for schools to reach the fourth stage of technology adoption. However, this estimate would vary from school to school depending on various parameters like “tech-awareness” of teachers and the drive in the stakeholders to make technology usage in education a reality.

Infrastructure Investments:

Schools administrators are often worried about the cost of the infrastructure involved in moving up the technology adoption pathway. Integrating technology with education demands commitment of infrastructure and is different from just wiring a few assembled PCs together. The investment in infrastructure will increase in each stage as users will not only start using technology to the fullest, but also require more sophisticated digital tools. The expenditure on infrastructure in each stage should be determined by a cost benefit analysis based on a school's budget and requirements. There is a wide spectrum of cost effective options for schools. Along with networked computers, Internet connections, printers and scanners, schools need to build a helpdesk to offer easily available technological support to all users.

Making IT Happen

Train Teachers First

You can never train enough – therefore training teachers also cannot be a one-time investment, but an ongoing process. In our schools, where children are often more computer savvy than the educators and have computer access at home, it is essential that the teacher feels well prepared and confident in using technology. Schools should actively try to minimize the digital divide between students and teachers by providing equal access to technology and digital tools. Teachers will be initially enthusiastic to acquire the required skills, but when the time comes to put in the efforts to acquire new skills, resistance tends to grow. Schools need to provide teachers adequate support, since they are the cornerstone of technology adoption.

Monitor Implementation Closely

Finally, implementation of the technology adoption plan should be closely monitored. To track progress and troubleshoot problems a school should put into place a monitoring mechanism that assigns responsibilities to specific entities like an IT committee. The plan should be redefined based on new objectives and resources and new developments in technology as the months go by.

Our schools now face the challenge of preparing their students with the skill sets required to contribute to a competitive and dynamic 21st century, global workforce. Successful adoption of technology should involve all stakeholders, school administrators, teachers, parents, students, education boards and the community. Ensuring that our students achieve higher education standards and become highly productive members of a global society, should be our nation's effort.

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