ICT in Education in India

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Abstract

Technological leapfrogging offers an opportunity for developing countries to catch up with modern ICT resources. In practical terms, leapfrogging is "bypassing some of the processes of accumulation of human capabilities and fixed investment in order to narrow the gaps in productivity and output that separate industrialized and developing countries. This phenomenon is most obvious in India's education sector. The advent of ICT technologies has changed the teaching and learning paradigm in this country. Government and private programs of adopting wireless internet and broadband in schools and teaching and learning technologies like smart classrooms, e-learning, multi-media courseware, in addition to school administration technologies and affordable hardware and software has shown exponential growth. Despite India being the largest educational systems in the world, literacy rates are very low. In this paper we examine the impact of new educational technologies on India.

INTRODUCTION

The rapid diffusion of computers and Internet use has been a fixture of the global landscape over the past decade; nonetheless, rates of technology use still differ markedly across countries. For example, the latest estimates from the International Telecommunications Union (ITU) indicate that only 6 percent of the population in India used the Internet in 2007. In contrast, more than 50 percent of the population in all developed countries used the Internet, with rates of technology use being substantially higher in many European and North American countries. These disparities in technology diffusion may have important economic consequences because technology use may increase knowledge diffusion through improving communication efficiency (e.g. Jovanovic and Rob, 1989), improve political engagement (Norris, 2001), increase productivity (Brynjolfsson and Hitt, 2003, Dedrick 2003), and allow developing countries to "leapfrog" traditional methods of increasing productivity (Steinmueller, 2003).

The importance of ICT diffusion in developing countries to economic advancement has been stressed in the policy arena and previous literature (Wallsten 2005). For developed economies, the literature is fairly well developed, while the implications for developing countries are only now being explored in a systematic fashion. To the extent that the pace of economic growth is dependent on the rate of ICT diffusion, we believe it is important to examine the factors that hinder the uptake of new ICT's in education.

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For more than forty years, innovative educators have been optimistic about computer uses in schools. Their vision for computers have not been realized to nearly the extent thought possible, despite a rapid fall in the price of hardware, the exponential increase in computing power, and the development of the Internet, which has opened a host of new possibilities not conceived a decade ago. The main obstacles in education to incorporating ICT into the teaching-learning process are not obvious. In this paper, we try to understand better where the problems lie and examine the case of a developing country like India.

The outlook towards education is changing throughout the world and especially so in a developing nation like India where instead of being considered an expense it is now seen as an investment for the future. With children's education a key priority in every household today, they believe any call on a thematic investment opportunity identified in this sector will yield long-term benefits. In order to sustaing its approximately 8% growth, India has to invest in education and more so quality education.

India is one of the largest markets in the world for formal school education with an addressable population of about 400-450 million and an annual spending of about $80 billion dollars. Rising middle class income levels will act as a catalyst in increasing the accessibility and quality of education. Forecasts indicate that the number of individuals with an annual average income of over $5000 will increase from 12 million people in 2004, to over 350 million people by 2020.

Individual households spend approximately 9 percent of their income on education, which is second only to food and groceries in an average consumption basket. Average spending on child's education across the country is approximately $350 per year with the highest level of spending occurring in southern India at $450 per year. With the rise in income, households have set very high aspirations for children with 43 percent wanting their kids to get a master's degree and 29 percent a doctorate. Population growth has decreased from 2.1 percent to 1.7 percent which should create greater accessibility for quality education than in the past. The country's labor force will grow at 1.70 – 1.84 percent up to 2015. 13 million people enter the workforce each year in urban India and 23 percent of the global work force addition over the next 5 years is expected to be from India.

Part of the reason for the slow growth of the education sector in India is its overdependence on government funding, a situation which is beginning to change. The focus of the government so far has been to increase access to education till the metric level, instead of on quality or employment opportunities.

A number of new initiatives have been undertaken in the education sector. The entry of new private schools in both the "K to 12" segment and vocational training offer immense potential in terms of growth. The adoption of new technologies by the education sector also offer new opportunities for learning and the acquisition of valuable and transferable skill sets for the development of human capital and to increase the management and accountability of the education sector. A key problem with the education sector is the issue of efficiency, effective teaching and accountability.

The reasons for failure of the education sector till date were long outstanding neglect, insufficient public financing and accountability. Of all the children who enroll in schools, over 50 percent drop out by

class VII and 70 percent by class X. The country has recently begun investing in education. Public spending on schools has increased over the last few years and the government now proposes to triple its current spending on education from its current 3.5 percent of GDP.

The XIth Five Year Plan is in fact a "National Education Plan". Proposed outlays on education would be up from 7.68 percent of the Central Gross Budgetary Support in the Xth Plan to over 19 percent in the XIth Plan. Total spending by the GOI on the education sector is set to exceed $40 billion in fiscal 2008. Incorporated into the plan is the belief that Private Public Partnerships (PPP) should be encouraged to enhance the critical priority sectors of education, infrastructure and facilities in schools and teachers' training institutions and examinations reforms.

The sector offers immense potential considering India's poor literacy rate of 67% (as of 2004-05) and with the employable population set to account for close to 60-65 percent of the total population over the next 10-15 years. The market in India for education could be one of the largest markets in Asia with a population of over 1.13 billion. With the government planning to spend around 5 percent of GDP in the next 5 years on education, the market could be any where worth $ 65-100 billion according to some industry reports.

ICT IN EDUCATION – A REVIEW

Most analysis of ICT in the educational sector focuses upon the impact it has had on pupil teaching/learning. However, direct changes in the way teaching and learning are organized should be only part of the effect ICT has in the organization of the education sector. We analyze the role of ICT in education in three parts:

- Changes in the management of the educational sector associated with ICT.
- Changes in the work process in education associated with ICT.
- Changes in the training of educational personnel and of students associated with ICT.

As in business, ICT has contributed greatly to networking among schools and universities and among individuals in schools and universities. This has been especially true in the developed countries, and is now spreading to developing countries. For example, *Enlaces*—the Chilean government's educational ICT system— has made a priority of connecting rural schools to the Internet and thereby integrating them more tightly into the larger educational system, and hooking them up to the outside world. Many school districts and almost all universities now communicate internally and externally largely through e-mail.

Schools and school districts hardly use ICT to manage the quality of output, to raise teacher productivity, or to reduce costs through analyzing spending. Beginning in the 1970s US school districts regularly used computers to store student and personnel data. With the advent of high-speed personal computers in the 1990s, computers became a permanent fixture in school offices. In many school districts in the U.S., school administrators have access to data from district computers; in many schools, individual teachers are hooked up to central data files either in the school or district office. Educational

administrative offices in most developed countries have ICT, and data collection in the developed world is universally computerized.

Bilateral assistance agencies and international banks put increasing emphasis in the 1980s and 1990s on using ICT to collect educational data and to improve the administration of educational systems in developing countries, particularly through decentralizing educational offices to regions, states, municipalities, and states themselves. As in developed countries, such ICT systems have been used mainly for collecting enrollment data, student attendance, basic information on teachers, and basic information on schools. In other words, ICT mainly helps administrators get a better idea of the size of the educational system, student dropout and repetition, and the number of students per teacher.

In some sense, this can be characterized as measuring the "efficiency" of the educational system and as a first step in improved resource allocation. We could liken this to inventory control in business. Educational administrators need to have basic information on student and teacher flows, probably also of school supplies, and how much the system is spending on various inputs, in order to make the most basic resource allocation decisions. Undoubtedly, ICT has played an important role in improving data collection in educational systems. It has also made these data more widely available to school personnel, parents, and the public at large through central administration web sites, and in some countries through direct access to central or district databases by school personnel.

These rudimentary data collection functions are expanded in some countries and regions by more sophisticated quality control data, namely student evaluation data. France makes available the results of the *baccalaureat* examination, school by school, on the Ministry's Web site. These results are presented in "adjusted" form, corrected for the socioeconomic background of the students in each school. Chile also makes available the results of its national SIMCE assessments at the 4th, 8th, and 10th grade, school by school.

Until 1996, these results were only available to schools; now they are also posted on the Web. States such as Texas and North Carolina are pioneers in using testing in grades 3-8 and a high school exit test to monitor individual school "success or failure" with students from different ethnic groups. Now many states use similar state standards and testing to monitor schools. ICT is crucial to these national and state accountability systems, both in collecting/processing the data and disseminating the results. In all these systems, however, the centralized administration uses ICT to "regulate" the system from above. It collects information from and distributes information to the different "departments" (schools), and uses the information to extract greater effort from the different parts of the system. In many countries, such top-down use of ICT to monitor performance could be extended to collecting and disseminating information on student and teacher absenteeism, student attainment (achievement levels), and other variables, all on a school-by-school basis.

As mentioned above, top-down monitoring is a typical use of ICT in business applications. The education industry is largely public, marked by permanent contracts and wage negotiations that have little to do with measures of productivity. Thus, any effort to measure educational productivity, even of firms

(schools), could be considered as moving in the direction of labor "control," of attempting to take "autonomy" away from teachers.

Such top-down administrative controls are not widely practiced even in developed countries, especially those with more decentralized systems. The single most prevalent form of centralized control is a standardized curriculum and a system of inspection. This system is supply based. It assumes that if the technology (curriculum) is fixed, and teachers are applying the technology (this is controlled by the once per year inspection), student will learn at an expected rate. In practice, supply based management leaves an enormous amount of control of the educational process in the hands of individual, unsupervised, un-evaluated teachers.

In all the cases mentioned attempts to augment centralized control with student evaluations, the central administration uses ICT to regulate schools but leaves to schools (decentralized administrative units) the choice of method to improve performance. How much of a role does ICT play in helping schools do better, either in improving school attendance, student test scores, or student promotion? In France and Chile, for example, the curriculum is centrally controlled, and student evaluations in 3rd and 6th grade in France and in 4th, 8th, and 10th grade in Chile are all tied directly to the standard curriculum. Similarly, in many U.S. states where students are regularly tested and schools judged on the basis of test scores, individual student test scores are made available to schools (in France, the tests are graded by school personnel at each school). With computer capacity available to schools, it would not be difficult to assess student results against components of the curriculum.

In states or countries where students are tested in every grade, it would be possible to assess student progress grade-by-grade (gain scores) in each school—provided that students stayed in a school. Patterns of incorrect answers by students could even be matched to individual teachers, thus helping teachers improve their productivity, at least in terms of test items.

There is evidence of teacher resistance to external accountability using student testing as a measure of school productivity (Benveniste, 2000; DeBray, Parson and Avila, 2002). However, teacher resistance has not impeded the application of external accountability, and there are some studies that indicate its positive effects on student outcomes, particularly in mathematics (Grissmer and Flanagan, 2000; Carnoy and Loeb, 2002).

How much is ICT used at the *school and local district level* to improve productivity? Certainly, good school administrators do use data to improve student performance, but there is very little evidence that ICT is widely used even in countries where schools have ample computer hardware and software to use available information in this way. Educational administrators at the department level are unlikely to use ICT for managing educational output or quality. Nevertheless, under pressure from state-based external accountability demands, some schools are using specially prepared software packages that allow teachers and the school to measure student gains on tests and compare test items missed by individuals and the sum of individuals in a evaluation.

Why is ICT used so much less in educational management decision-making than in private business? One argument could be that it is not being used this way because it would not be useful for increasing productivity, and that teachers, the production managers in education, realize this and resist applying ICT to assessing student learning gains at the classroom and school level. A major use of ICT in business decision-making is gathering data on various aspects of business performance (sales by department or sub-department, for example) and, on the basis of that data, assessing how performance can be improved. In education, data on student performance (test data) is readily available in many schools and school districts, and these data can be related to curricular content to assess whether required or tested curriculum is being applied.

However, many educators have claimed that measuring learning through achievement tests essentially pushes schools to teach the tests, and is detrimental to a broader, more valid conception of learning (see, for example, McNeil, 2000). Constructivist approaches to education argue that understanding arises as learners through prolonged engagement relate new ideas and explanations to their own prior beliefs (OECD, 2001, p. 26). Standardized testing, many argue, fails to measure this understanding; hence, analysis of test data would lead to incorrect educational decisions, often pushing teachers who might be providing 'understanding' of the material to focus on teaching test items.

The other side of this coin is that ICT used for student-centered teaching, in which student engagement, hence greater understanding of the material, may require new kinds of assessment tools. In its recent publication, *Learning to Change: ICT in Schools*, the OECD discusses recent work by Voogt and Odenthal (1999), who "… have proposed a series of *emergent practices* associated with the integration of ICT in education, which imply and invite radical change. They see an emphasis on skill development and on cross-disciplinary activity more in keeping with real life, developed and accredited through formative and summative student assessment by a variety of means, including portfolios. Students will themselves, accept more responsibility for their own learning and its assessment, developing expertise in the process" (OECD, 2001, pp. 28-29). The OECD study further concludes that the potential of ICT will not be realized as long as assessment is primarily in terms of student achievement in single subjects, by means of conventional written tests (OECD, 2001, p. 31).

Yet, this does not explain why ICT has not been more extensively used in translating traditional assessment procedures into more systematic educational improvement. It would seem logical to harness the information processing power of today's desktops to monitor student progress on curriculum-based assessments. With more workers (teachers) per supervisor (school directors and academic supervisors) than in almost any other industry, we should see ICT more extensively utilized to assess student performance gains classroom by classroom. Even if we assume that teachers would resist such external supervision, in the current accountability environment, we should observe ICT being increasingly used by teachers for assessing and improving their own performance in meeting state and national standards. The fact that little of this occurs anywhere suggests that there are major barriers to employing ICT as an administrative tool in schools.

One obvious barrier could be teacher resistance, as discussed above. But there are many ways that ICT could be used in helping teachers assess their individual work, or their collective work with other teachers in their school. Benveniste (2000) shows how external assessment was applied in Uruguay, with teacher union participation, and greater teacher involvement and acceptance at the school level than in Argentina or Chile. If teacher resistance were the main obstacle to ICT as an administrative tool, we should observe much more teacher shaped assessment using ICT. This would be analogous to business applications where labor unions are involved in defining productivity measures and worker evaluation. We rarely observe any use of ICT by teachers even for self assessment.

Rather, the most important barriers appear to be the lack of data analysis skills among administrators and teachers and, until recently, the lack of user-friendly software for analyzing test results at the school level. Few school directors, their staffs, or teachers are trained in using basic ICT tools such as Excel or Edusoft and in applying them to assessing student performance in schools and classrooms even in states that have provided major incentives to schools to do so by pressuring them to approve through both moral and financial rewards and sanctions.

Even these centralized analyses are relatively limited. In those countries and states that implement accountability systems, schools and districts are usually responsible for finding the means to improve student performance, yet have little or no capacity to do so.

In some OECD countries, were there is a tradition of educational research, or collecting extensive data on education, and making these data available to researchers, there is considerable analysis of educational productivity. In the past decade, Chilean researchers, assisted by the Ministry of Education, have also begun doing extensive analysis of Chilean educational data on a regular basis using the power of ICT. Yet, even in these countries, ICT as a management tool has not reached into local school districts and schools. From this analysis, the most obvious policies inside education that could stimulate more use of ICT in educational management would be widespread training of secondary school and university students in using ICT-based management tools and preparing high school students and education majors in college in rudimentary statistical analysis. By making such training part and parcel of a general educational preparation, the younger generation of teachers and educational administrators would be highly trainable in using data to assess their students' and their own work.

INDIAN SCENARIO

Investment in the education sector would be required for India's impressive figures of economic growth to continue. This is one sector the outlook towards which is changing, from being considered an expense it is now taken as an investment for future.

There are about 20 million persons entering the work force each year. It is therefore essential to create the environment that will encourage the individuals to take up self-employment. While loans, fiscal incentives and appropriate policies are necessary; we believe the education sector will play a major role.

Of all the children who enroll in schools, over 50 percent drop out by class VII and 70 percent by class X. Most of them, as also many who complete schooling, then join the unofficial workforce, doing odd jobs on farms, homes or in the millions of small business that abound in both the city and village. In a short period, they pick up rudimentary work skills, learning on the job, and life skills that enable them to cope with an adverse environment. The few or even many years of traditional school education contribute little to prepare them for such work or for the environment.

India is of the opinion that vocational education will be very important going ahead as many traditional occupations face extinction due to industrial production and change in life styles. A host of new technology products are entering the markets and into the lives of people. These offer immense opportunities for self-employment, which calls for vocational training.

Vocational training has not been very successful in the past. Vocationalization of secondary education, introduced in 1988 at the +2 stage, did well initially but later lost stream. At the university level, career oriented courses were introduced in 1994 but have never been popular.

Different ministries have initiated numerous other schemes, but none seem to have really been successful. The major problems are insufficient practical training, irrelevant courses and inadequate training of faculty. Overall, the lack of involvement of practitioners and a lack of market responsiveness seems to be the problem.

Fewer schemes, far greater involvement of industry, responsiveness to market needs and a well-structured programme of faculty training should be the areas to focus on. In order to promote self-employment, the course must include training in entrepreneurship and low cost loans must be made available to all who pass such courses. Courses must begin at the school level and must be made available to school dropouts too.

We believe a massive programme is urgently needed, implemented as a public-private-partnership (PPP) and focusing on the disadvantaged, especially in poorer areas Such an effort can increase productivity, create jobs, and provide substantial benefits to individuals and society.

Some of the main challenges before the Education System in India pertain to:

- Access-While availability of elementary schools within a reasonable distance from habitations is now fairly universal; same cannot yet be said in regard to Secondary Schools and Colleges. Pockets still exist in many remote parts of the country where the nearest Secondary School or College is much too far for everyone to be able to attend. Besides the physical availability of institutions, other barriers to access – e.g. socio-economic, linguistic– academic, physical barriers for the disabled, etc. – also need to be removed.
- Participation & Equity**-** Gross Enrolment Ratios for the elementary, secondary and tertiary stages of education in 2003-04 were 85%, 39% and 9%, respectively. These participation rates are undoubtedly low, and need to be raised very substantially, for India to become a knowledge society / economy. A linked challenge is one of equity. Participation rates in Education are poor largely because students from disadvantaged groups continue to find it

difficult to pursue it. Even when they manage to participate, students suffering from disadvantages of gender, socio-economic status, physical disability, etc. tend to have access to education of considerably lower quality than the others, while the education system needs to provide them access to the best possible education so that they are able to catch up with the rest.

- Quality- The challenge of quality in Indian education has many dimensions, e.g. providing adequate physical facilities and infrastructure, making available adequate teachers of requisite quality, effectiveness of teaching-learning processeș, and attainment levels of students.

Besides the need to improve quality of our educational institutions in general, it is also imperative that an increasing number of them attain world-class standards and are internationally recognized for their quality.

Education in India needs to be more relevant and skill-oriented both in terms of life-skills as well as livelihood skills. In sheer numerical terms, India has the manpower to substantially meet the needs of a world hungry for skilled workers, provided its education system can convert those numbers into a skilled work-force with the needed diversity of skills. Management of Indian education needs to build in greater decentralization, accountability, and professionalism, so that it is able to deliver good quality education to all, and ensure optimal utilization of available resources.

Resources need to be expanded. India's stated national policy since 1968 has been to raise public expenditure on education to the level of 6% of GDP. On the other hand, in 2004-05, outlay of central and state governments for education amounted to only about 3.5 percent of GDP. Thus, the gap in allocations for education is still substantial, and needs to be urgently bridged.

OUTLOOK

Whether in India or in the West, the markets for educational content services provide unlimited opportunities to the few players operating in this segment. We believe India needs a greatly expanded supply of educated and skilled labor to support ambitious growth targets. Education is the best hope for achieving inclusiveness and for spreading development to backward regions and marginalized groups. Nothing would ensure an effective spread of opportunity to all sections of the population more than the availability of good quality education especially in rural areas.

This will be possible only through inclusiveness in the education sector and by spreading development to backward regions and marginalized groups. Right now, in the education sector there is severe competition for the market—a limited number of entrants are allowed. So there is limited competition in the market leading to high prices (and economic rents, part of which has to be paid to the operators of the state control machinery to gain their patronage). Limited competition in the market

implies not just high prices but assures low quality also. The people, given the supply constraints, in desperation put up with high prices and low quality.

Free entry should be allowed in the education business. By doing so there will be no competition for the market, there would be competition in the market. Prices will reflect true costs and the quality would also improve.

In Asia, countries like Japan, which once turned out students that consistently ranked at the top of international tests are now looking for lessons from India. The Japanese bookstores are filled with books like “Extreme Indian Arithmetic Drills” and “The Unknown Secrets of the Indians”. The countries perceive India as the world’s ascendant superpower.

The Indian education space could be one of the largest markets in Asia with a population of over 1.13 billion. With the government planning to spend around 5% of GDP on education in the coming five years the market could be any where worth $ 50-55 billion.

One cannot dispute the fact that for any transformation in the sector all we need is new plans with our old attitudes. Fresh creative thinking and out-of-the-box solutions will only do the trick.

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