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राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्
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Executive Summary

Educational Technology (ET) is the efficient organisation of any learning system adapting or adopting methods, processes, and products to serve identified educational goals. This involves systematic identification of the goals of education, recognition of the diversity of learners' needs, the contexts in which learning will take place, and the range of provisions needed for each of these.

The challenge is to design appropriate systems that will provide for and enable appropriate teaching-learning systems that could realise the identified goals.

The key to meeting this challenge is an appreciation of the role of ET as an agent of change in the classroom, which includes not only the teacher and the teaching-learning process but also systemic issues like reach, equity, and quality.

Over the past decades, educational technology in India has taken two routes:

The first route involved a large number of experiments aimed at the qualitative improvement of schools, adopted the systems approach to analyse the problems plaguing the particular situation, and have evolved a range of solutions. These have included the development of flexible systems, alternative curricula, multilevel organisation of classes; low-cost teaching-learning materials, innovative activities, continuous support systems for teacher training, etc. While many of these experiments have demonstrated intrinsic merit, they have been restricted to pockets of intense practice and have failed to influence the larger school system.

The second route is government sponsored schemes such as the Educational Technology (ET) Scheme and the Computer Literacy and Studies in Schools (CLASS) and their present-day analogues, including partnerships with global players. This included the supply of radio-cum-cassette players, colour televisions, microcomputers, present-day computer labs, and even satellite-receiving terminals. These schemes have largely remained supply-driven, equipment-centred, and disseminative in design. Scant attention has been paid to the development of the entire support system that would establish ET as a reliable, relevant, and timely intervention, and despite clear indications of the necessity for this action.

Information and Communication Technologies (ICTs) have brought in a convergence of the media along with the possibility of multi-centric participation in the content-generation and disseminative process. This has implications not only for the quality of the interchange but also for drastic upheavals of centre-dominated mindsets that have inhibited qualitative improvement.

Modern ET has its potential in schools, in the teaching of subjects, in examinations, in research, in systemic reforms, and, above all, in teacher education, overcoming the conventional problems of scale and reach through online, anytime, anywhere.

There exists today a well-established publishing industry, including desktop publishing, with

know-how and capabilities in producing kits, teaching aids, etc. There also exist production capabilities for audio and video, multimedia, broadcast channels, Internet connectivity, trained manpower, and institutions with these mandates that can be leveraged to address the challenges of education.

Alternative models of education such as distance and open-learning, on-demand education, and other such flexible models of learning, will have to be tried and tested. Flexible systems, futuristic curricula, and a twenty-first-century career orientation have become a necessity for today's young people. There is an urgent need to convince the educational system, which should play an important role in engineering the teaching-learning situation and to make it a more meaningful experience for both teachers and their pupils.

The Focus Group therefore suggests the following:

In revitalising and reorienting existing resources

- Capitalise on the existence of a large number of institutions and facilities, nationwide networks, and trained, professional, and creative manpower in the area of ET. Re-engineer and convert all of these into a potent system.
- Encourage these institutions to take up new roles, including action research, data collection, in-service training of teachers, networking to establish and coordinate nationwide efforts in education, evaluation research, developing models for interactive classes, interactive multimedia, teleconferencing, video conferencing, and in leading the process whereby materials can be generated by teachers, parents, and children at every level.
- Recognise the potential of ICT and the Internet, promote universal access, facilitate participatory forums, and develop communities and interest groups.
- Invest in continuous, on-demand teacher training and support, research and content repositories, value-added distance education and online campuses, all of these steps aimed at increasing access to, and equity and quality of education.

In systemic reforms

- Ensure that technology is used in an equitable and democratic manner to enhance the self-worth and self-image of the poor and the disadvantaged.
- Counter the tendency to centralise; promote plurality and diversity.
- Ensure opportunities for autonomous content generation by diverse communities.
- Shift focus from fixed to flexible curricula, with competencies and skills identified rather than specific factual content.
- Deploy ET to enhance open education, which implies openness in curriculum transactions.

- Work towards transforming all schools into ICT-rich environments.
- Create opportunities for administrators and educational leaders in the school system to become ET savvy and to be able to use ICTs competently.

In refreshing skills of in-service teachers

- Create a system of lifelong professional development and support, especially for educational leaders and managers such as headmasters and principals.
- Encourage ICT literacy for official and personal use to build comfort and later creativity in educational work.
- Support the development of and nurture teachers' self-help groups / professional development groups both on the ground and online.

In pre-service teacher education

- Introduce teachers to flexible models of reaching curriculum goals.
- Introduce use of media and technology-enabled methods of learning, making them inherent and embedded in the teaching-learning process of teachers.
- Train teachers to evaluate and integrate available materials into the learning process.
- Enable trainee teachers to access sources of knowledge and to create knowledge.

In school education

- Move from a predetermined set of outcomes and skill sets to one that enables students to develop explanatory reasoning and other higher-order skills.
- Enable students to access sources of knowledge and interpret them, and to create knowledge rather than be passive users.
- Promote flexible models of curriculum transaction.
- Promote individual learning styles.
- Encourage use of flexible curriculum content, at least in primary education, and flexible models of evaluation.

In research

- Create a framework to identify the generic skills (problem identification and troubleshooting, for instance) needed for the new initiatives to be undertaken in ET.
- Acquire knowledge on how learning takes place in ICT-rich learning environments, optimizing learning paths for learners with different learning styles coming from a variety of social backgrounds, including gender differences.
- Examine the possibilities of mobile technologies for learning purposes.

The Indian perspective on ET essentially requires looking at the scenario related to the evolution of ET in the country and the periodic changes carried out in policies and curricular concerns. This look at the development of ET in India and the current scenario, which involves efforts from both the Government and Non-Government organizations, should provide several pointers towards how ET could be used fruitfully now, and in the future, to attain the desired educational goals and to enhance meaningful learning in the rapidly changing world of the 21st century. These issues and concerns are discussed in the succeeding pages. While looking at policy changes and research findings, the Focus Group found that the term ET is construed differently in different programmes and by different agencies. We have, therefore, decided to begin by clarifying both the term and all that it implies.

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Appendices:

1. What is Educational Technology?

The reason why the term ET is misconstrued is on account of the changing nature of ET's second component, viz., technology. The basic tenet of ET, viz., using all available resources (human and non-human) in a systematic manner to find viable solutions to educational problems, does not change. However, as technologies change and newer ones are brought into service in education (or, for that matter, into other spheres of development), the configurations, structures, and applications of ET will also change. This dynamic and ever-evolving nature of the discipline needs to be understood. Further, given the fact that educational problems are diverse, so are their solutions, ranging from providing resources in the classroom to distance education or using technologies to facilitate communication. These multiple facets of ET make a crucial difference to the way in which the term is interpreted. As the discipline continues to grow, we would like to give a short account of its evolution.

When the term was first coined it referred to "technology in education", implying the use of a variety of audio-visual aids (as they were then known) for teaching purposes. Implicitly relying on the then widely accepted sender–receiver construct, educational writers saw these aids primarily as transmitters of lesson content.

As the concept of ET developed, the term "technology of education" came into vogue. This looked at education in a wider sense, and included various aspects such as entry behaviour of the learner, objectives, content analysis, evaluation, etc. By the mid 1970s, ET borrowed the terms "systems approach" from management studies and "corrective feedback" from cybernetics. This widened the scope of ET as the teaching-learning process was examined in a holistic manner.

The arrival of digital convergent media encouraged interactivity and interconnectivity. This added a new dimension to ET. It gave an impetus to its further development as a discipline. While this field continues to evolve, we are faced with the problem of how to help learners to help themselves in learning in an effective and interactive manner.

As the Focus Group deliberated, we felt that when we talk of the role of ET, we should direct our thoughts to education, and not to any technology and the logistics of getting it set up. The emphasis has to be on a culture of learning rather than on technology per se. Our perspective is that, except in the case of teacher education where ET is taught as a subject, ET is a value addition to quality, relevance, appropriateness, and other such attributes, transforming education by making it dynamic and responsive to the passions that move the learners and arouse their curiosity and desire to learn.

The desire on the part of some people to leave the term ET behind is rooted in the awareness that historically the implementation of ET in India (and many other countries too) has been centered on machines and the educational software related to them. Such interpretations are easy to understand. More difficult to comprehend are approaches based on processes. Here we speak of the processes adopted by educationists to solve the difficulties that the prevalent system of education has in enhancing learning to meet the desired educational goals.

The universally accepted definition of ET involves processes, methods and techniques, products, resources and technologies organized into workable systems. The recognition of the need for a multilevel organisation of a classroom, for instance, along with the designing of an appropriate programme and its implementation, become as much an exercise in ET as the use of audio-visual aids or the information superhighway.

There is also a prevalent belief that modern technologies are better than older ones. Certainly, they offer many exciting possibilities, but both old and new serve different purposes of teaching learning, and are probably equally relevant in different given contexts.

The key phrases in ET are appropriate technology, that is, appropriate to the task in hand for meeting specific educational objectives, and the organization of all available resources into a workable system, which is checked again and again to ensure that it is appropriate and changing it where it is not working. Formative evaluation and summative evaluation are essential parts of ET. In applying the discipline of ET to the field of education, it is imperative that the media choice must relate to instructional design as well as to what is available and eminently usable.

The same is true of methods and techniques. For instance, the memorization of facts as a learning strategy still has a role to play. The ready availability of multiplication tables (pahadas) does speed up computation. It is the overgeneralization and unthinking application in inappropriate situations that has brought disrepute to memorization as a form of learning. Charts, graphs, textual materials, experimental kits, projected electronic aids, audio materials, computers, films, videos, the Internet, etc. can usefully serve the purposes of education in their own special ways and together they can make learning an enriching experience.

ET could be defined in simple terms as the efficient organisation of any learning system, adapting or adopting methods, processes, and products to serve identified educational goals. This would involve:

- Systematic identification of the goals of education, taking into account nationwide needs (higher scalability, for instance), the system capabilities, and the learners' needs and potential.
- Recognition of the diversity of learners' needs, the contexts in which learning will take place, and the range of provisions needed for them.
- Recognition of not only the immediate needs of children but also their future needs in relation to the society for which we are preparing them.
- Designing, providing for, and enabling appropriate teaching-learning systems that could realise the identified goals.
- Developing a range of support systems and training, creating the enabling systemic conditions/materials, reaching these to the school system, and training teachers and students to use them.
- Research into existing and new techniques, strategies and technologies for solving problems of education, enabling judicious and appropriate application of technology.
- Appreciation of the role of ET as an agent of change in the classroom, influencing the teacher and the teaching-learning process, and its role in systemic issues like reach, equity, and quality. (This appreciation should not be limited to educators alone, but should extend to planners and administrators as well, since systems both at micro and macro levels will be necessary to meet the current challenges of education.)

2. Historical Perspective

The basic elements of ET have always been present in any effective teaching-learning system, though it was not called ET. For example, the old gurukul system in India stressed individualized instruction and emphasised learning, which are also features of ET. The training

programme in the gurukul was devised to suit the needs and abilities of the pupil. It was a one-to-one (guru-shishya) system, but it did not mean rote learning or following the guru blindly. A Sanskrit maxim (Shishyat icchet parajayam) states that the fervent wish of a guru should be that his disciple would better him. Moreover, the teaching programme was devised not only to suit the needs and potential of the pupil but also to suit the societal needs as expressed in identified learning goals.

One such goal, for example, in the days when writing was unknown was to maintain the oral tradition of the Vedas. Hence, it was important to preserve intact the accent and pronunciation of words. The method adopted was the memorisation of text, and the technique for doing so was using different pathas or sequences, which could be recited against each other to check any deviations.

The factory system of education with its centrally controlled curricula/-text-books/school hours/ holidays, etc. came with the British rule. Then, as Gandhiji ruefully noted, every alternative school system was abolished.[1] This colonial legacy and control apparatus continue to plague the educational system even today, almost six decades after India gained political independence. As a result, we are now in the sorry situation so well described in the Yash Pal Committee Report "Learning without Burden".

2.1 Efforts to Mobilize ET, Large and Small

A number of groups doing innovative work in the field of ET in India and abroad made presentations of their work and experiences before the Focus Group. The list of presenters along with their topics of presentation is given in the Appendix. In addition, teams of Focus Group members visited several innovative programmes and made presentations to the group. The boxes in this paper give information about some of these programmes. Readers may visit their respective websites for additional information.

2.2 Initiatives in the Voluntary Sector

Several educators from Gandhiji onwards have sought to make education relevant and liberating by introducing alternative and experimental systems of learning. They have also tried to provide equity and quality in education by directing their efforts towards educating the marginalized child and providing the needed skills and knowledge in stimulating ways.

Gijubhai Badheka and Tarabai Modak worked in the sphere of early childhood education. The Tilonia programme in Rajasthan; the Hoshangabad project of Kishore Bharati / Eklavya in Madhya Pradesh; Gram Mangal (an extension of the work done by Tarabai Modak and Anutai Wagh with tribal children) in western Maharashtra; the Bhandup project and the Avehi-Abacus project in Mumbai's municipal school system—these are

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[1] *"I say without fear of my figures being challenged successfully that today India is more illiterate than it was fifty or hundred years ago, and so is Burma, because the British administrators, when they came to India, instead of taking hold of things as they were, began to root them out. They scratched the soil and began to look at the root, and left the root like that and the beautiful tree perished. The village schools were not good enough for the British administrator, so he came out with his programme. Every school must have so much paraphernalia, building, and so forth. Well, there were no such schools at all. There are statistics left by a British administrator which show that, in places where they have carried out a survey, ancient schools have gone by the board, because there was no recognition for these schools, and the schools established after the European pattern were too expensive for the people and therefore they could not possibly overtake the thing. I defy anybody to fulfil a programme of compulsory primary education of these masses inside of a century. This very poor country of mine is ill able to sustain such an expensive method of education. Our state would revive the old village schoolmaster and dot every village with a school for both boys and girls."* Mahatma Gandhi speaking at Chatham House, London, 20 October 1931.

a few examples of such efforts undertaken and sustained at various times in different parts of the country. Information on the Bhandup project, the Gram Mangal project, and the Avehi-Abacus project is given in Appendix Nos. 1, 2, and 3 respectively. Some of these projects like Tilonia, Hoshangabad, and Bhandup were replicated in a large number of schools after their efficacy had been proved in the project mode. However, even though the Tilonia and Hoshangabad models showed good results in the wider mode too, they were stopped because there was no political will to sustain them. The Bhandup project suffered neglect because the new municipal bureaucratic regime could not be bothered to continue it. The Bhandup programme continues to work well in those districts where the district education officers are supportive. It is sustained by teachers who have seen how children come alive and learn enthusiastically with multilevel teaching. This programme lets children move at their own pace, provides learning materials made at low or no cost, and encourages peer learning.

None of these projects (except possibly the Bhandup one) are known as ET programmes of enhanced learning, but each of them displays most of the features of ET as described earlier, viz., specific educational objectives, appropriate methods and materials, and emphasis on learning rather than on teaching. Indeed, the Centre for Educational Technology (CET), a former institute of NCERT, had funded the Tilonia project during its experimental stage as part of the Centre's ET programme. Many teacher-training institutions also offer courses in different aspects of ET such as programmed instruction, individualized learning, microteaching, etc.

2.3 Efforts Initiated by the Government

Mass media like radio and television have been used in a sporadic fashion for education for a long time. One of the earliest systematic and large-scale efforts in India to run an educational television channel was SITE (Satellite Instructional Television Experiment) in 1975–76, which was beamed to six states, and is well documented. Many innovations were undertaken in SITE in both devising and deploying suitable hardware (for example, battery-operated television sets in Orissa, ½" video technology) and making original software. This software was made by many agencies other than Doordarshan, which until then had a monopoly on video production and broadcasting in the country.

In this connection, the work done by AIR in its Vigyan Vidhi programmes to disseminate scientific information to students and teachers, or state and AIR efforts in the project mode in Maharashtra and Rajasthan, have been prominent. However, the supportive structure that these programmes needed could not be maintained for long. The first television inputs in education did not have any worthwhile support systems.

In 1970, the Ministry of Education took up a scheme of ET. Under this scheme, an ET unit in the Ministry, a Centre for Educational Technology (CET) under NCERT, and ET cells in six SITE states were set up in 1974. (There was a lot of time lag in thought and deed.)

Both CET and DECU (Development and Educational Communications Unit) of the Space Application Centre (SAC), Ahmedabad conducted formative and summative research in respect of the programmes that they had carried out. CET launched a multimedia programme of in-service teacher training (see Appendix No. 4), which was highly successful.[2]

There was excellent coordination between the state units and CET for the first few years. Every programme of CET was directed towards solving an educational

[2] *Evaluation studies by S. Shukla, Jagdish Singh and Suresh Batra, 1976 and 1977, and the report of Simon Maxwell of UNDP, 1976.*

problem or enhancing learning to achieve well-defined educational goals. The programmes were related to the education of marginalized communities. However, this vision was lost some-time in the early 1980s. With new directives from the Ministry of Human Resource Development (earlier known as the Ministry of Education), the close coordination between the state units and the central unit virtually came to an end.

The launch of the Indian National Satellite (INSAT) in 1980, and its availability for educational purposes, led the Ministry of Education to take over the production of educational television programmes for transmission via Doordarshan. INSAT for Education was conceived as a tripartite project, and was supported by UNDP, UNESCO, and GOI. Under its aegis, an Educational Technology Division in the Ministry of Education was set up; CET was merged with the Department of Teaching Aids of NCERT and was renamed as Central Institute of Educational Technology (CIET); some of the ET cells in the states were upgraded to State Institutes of Educational Technology (SIETs) and ET cells were opened in some other states. Studios with adequate hardware for production were installed. CIET was charged with the task of undertaking educational television and radio production, conducting training and research, and performing as a central coordination agency for all production and utilization efforts. Along with SIETs, CIET aimed at the utiliisation of mass communications in a major way to meet various educational objectives. These projects provided examples of the use of modern methods of media planning and application. The application of media in education in an Indian situation must take into account the availability of software and access to hardware. CIET conducted experiments in teleconferencing. The project seems to have reached sub-optimal achievement levels as after the initial planning, support systems were found to be lacking; the educational system has failed to appreciate the usefulness of the media programmes in their educational plans.

Television and radio sets were supplied to schools over many years. AIR and Doordarshan were chosen as the carriers for the broadcasts. As production and broadcasts began, equipment and personnel were put in place. So far as CIET and the SIETs were concerned, the production of video and audio programmes became their main work.

Narrow field studies showed encouraging results, but the system failed to take root. Large-scale evaluations show gross underutilization. Studies have shown that a link between the broadcaster and the classroom teacher has failed to develop. The audio and video programmes do not indicate any definite patterns of suitability for supporting classroom transactions or supplementing them, either for particular age groups or for particular subjects.[3] The broadcasting organizations have their own priorities, allotting timings not always suited to the audiences concerned, often canceling these when other programming takes precedence. The institutions in government related to ET have been ailing for some time. Three committees have pointed out the problems that these institutions have been facing, but no effective action has been taken to revitalize them.[4]

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[3] Studies by Dr R.L. Phutela (A Study into Utilisation and Comprehensibility of School Television Programmes in Delhi. New Delhi: NCERT, 1979) and Jagdish Singh (Two Case Studies of Educational Radio Programmes in Jalgaon and Jaipur. New Delhi: NCERT, 1977 and 1978).

[4] The B.S. Bhatia Committee (SIET–CIET Study, New Delhi: NCERT, 1994), the Kiran Karnik Committee (Learning Through Broadcasting, New Delhi: MHRD, 1997), and the T.N. Dhar Committee (Review Committee on CIET, New Delhi: NCERT, 2004).

Under another scheme of the Ministry that was entirely equipment driven, between 1986 and 1990, the Ministry distributed 2,28,118 radio-cum-cassette players (RCCPs) and 31,129 colour television sets to schools at the cost of several crores of rupees. However, as a study conducted by Prof. M. Mukhopadhyay shows, this step did not yield the desired results, as it did not go beyond providing the equipment.[5]

2.4 Computers in Education

Indian experiments in taking computers to schools involved the participation of a large number of institutions for tasks such as the supply of hardware and software, the development of Computer Assisted Learning (CAL) packages, and the training of teachers. A project called Computer Literacy and Studies (CLASS) launched in 1984 was a joint initiative of MHRD, Department of Electronics, and NCERT. It covered 42 Resource Centres and 2,582 schools. It made use of microcomputers provided by the BBC. The evaluation of the project by SAC revealed the need for greater interaction between resource centers and project schools, the need to reduce the time gap between the training of teachers, the installation of systems, and the initiation of activities in schools, the imparting of adequate hands-on experience to teachers and students, and the provision of computer literacy programmes in the timetable. The project had only a limited success, and has been described at best as a "spectator sport".[6]

A revised CLASS project during 1993–2004 saw the introduction of PC machines in keeping with broad global trends. Subsequently, the government: initiated the CLASS 2000 programme with the aim of providing computer literacy in 10,000 schools, computer-assisted learning in 1,000 schools, and computer-based learning in 100 schools. These 100 schools were called smart schools, and were designed to be agents of change seeking to promote the extensive use of computers in the teaching-learning process. This, too, has not yielded the expected results. In the words of Prof. Utpal Mallik, "Ambiguity of purpose, tentative policies and faltering practices marked the major computing initiatives in India during the last two decades . . . Schools are using IT as an add-on, not as an integral part of a new pedagogy."[7]

Though all these interventions did make some impact, where the schools and teachers went the extra mile to avail of the facilities provided using their own ingenuity, many of these schemes have been half-hearted attempts even at the conceptual level. Computer literacy is not so much about knowing the technical jargon, but rather learning to use computers in a meaningful way, that is, meaningful to children. Two programmes illustrate this fact quite well. The first project—which the media has dubbed the Hole in the Wall—uses the method of Minimal Invasive Education (MIE). (See Appendix No. 8.) The second programme was carried out by the TeNet group from

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[5] M. Mukhopadhyay et al. 1993. Utilization of media facilities in schools: An evaluative study of the ET scheme of the Ministry of HRD. Prof. Mukhopadhyaya describes his study not as a study of an educational technology scheme, but rather as a study of the utilization of media facilities.

[6] A study of CLASS, as part of a larger international study entitled "Schools, Teachers, Students, and Computers: A Cross-national Perspective, IEA 1993. University of Twente, referred to in a paper presented to the Focus Group by Prof. Utpal Mallik.

[7] Prof. Mallik and Ms. Kamal Deep Peter, both members of the Focus Group, stated that though the SMART schools were to be the showcase for educational innovation, the definition had been watered down to meet the size of the infra-structure of a school rather than the educational programme that it pursued. The quotation given in the text is taken from Prof. Mallik's paper "A bit of history to learn from . . . ", presented to the Focus Group.

IIT Madras as a one-month summer course for students of Class V.[8] (See Appendix No. 7.) The government-sponsored programmes lacked not only conceptual clarity but there were also no provisions for a number of other essential aspects, such as students and teachers having easy access to computers, problems of scalability, timetables, etc. None of these issues was discussed, nor were the relevant solutions worked out. Without such clarity and preparation, and lacking the machinery to make mid-course corrections, these programmes failed to bring about the desired changes; some were given up half way. Given this void, many international corporations, and Indian companies as well, have entered the arena in recent years. Their programmes have limited objectives. Appendix No. 9 provides information on some of them.

3. Emerging Lessons from Past Experiences

The lessons emerging from the analysis of successes and failures are immense. Equipment-driven programmes do not work. In the macro mode, in which broadcasts are used, unless there is an interactive mechanism—such as the teacher-monitor figure in the in-service multimedia teacher-training programmes of SITE or intervention by teachers, equipped with programme notes or textual materials—the success of the intervention cannot be assured. Radio and Television broadcasts are effective when they cover something that the class teacher cannot show or otherwise do or demonstrate in a classroom. The broadcasts have to be planned to suit the instructional design of an ongoing educational programme that is designed to bring about change, with both the broadcaster and the teacher learning from each other. Both CIET and the SIETs have made good enrichment programmes that show what the class teacher would usually not be able to show in the classroom; to that end, they serve some purpose.

But any disseminative arrangement, however good it may be, provides only limited gains because it only offers partial solutions to problems of an educational nature. Synchronous broadcasts also have some inbuilt weaknesses. Often the planning of programmes is too thin. What could be the contribution of one programme a week in one subject and that, too, when its objectives and functions are no different from those of classroom teaching?

With smaller interventions, things have usually worked fine during the peak periods, but often problems arise with respect to sustainability. Projects become person-centric. They become dependent on the central authority that runs the schools. *Good programmes once held up as exemplars are stifled because they run foul of the authorities, which have the power to close them down. When the colonial control mindset starts operating, innovations have no room to survive.*

An important lesson is that, whether one uses low technology or high technology, or micro or macro models, applying ET solutions to educational problems is a matter of a total fix. In other words, it is necessary to think of a total system. An important point to remember is that to ensure the success of even good television and radio programmes, it is essential to meet

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[8] The course on computers began by allowing children to paint whatever they wished. They then wrote text to accompany their pictures. They were then introduced to music, film clips, and graphics, and were shown how these diverse things could be edited and combined with their paintings. What would they like to do? Perhaps they could make greeting cards for their friends. The idea caught on, and it became a fun programme. Computer literacy is not about mugging the names of the parts of the computer, but in using it for one's own ends.

certain necessary conditions. First, the programme must meet the needs of students; it must be such that teachers could use it as an aid; the broadcaster must schedule it during a convenient time slot. The school has to fit this broadcast into the timetable. The production agency has to make appropriate programming available; post-telecast research has to support the production team and feed the data directly into the programme content. All these conditions will have to be met simultaneously, all the time, for such programming to achieve what its makers have planned. A piecemeal attempt will degenerate into tinkering, and the patches will begin to show much before the rust seeps out.

Some of these schemes, especially at the macro level, have been half-hearted attempts even at the conceptual level, and have failed in situations where the sharing of responsibilities by different agencies and the need to ensure that everything works in tandem are required. Constant evaluation and checking of systems is necessary because if mid-course corrections become necessary, they can be carried out in time.

India has now reached a stage where education must take recourse to the discipline of ET in organizing education because the challenges that the country faces today are far graver than ever before. Bringing about a sea change in education will be possible only if one applies ET in micro and macro models, using any technology—whether old or new— that is appropriate. There is no other option if one's goals are not to leave any child behind and to provide learners with education that is high both in equity and quality. ET has the potential to make the educational system flexible not only in the teaching of subjects but also in the conduct of examinations, in research, in systemic reforms, and, above all, in teacher education. It will also provide a buffer against the homogenizing onslaught of the global market economy on our culture and values by making the peripheries much stronger than before and providing discerning media awareness. Let us consider the challenges that we face.

4. Challenges in education

"Learning without Burden", the report of the Yash Pal Committee of 1993, has extensively reported on the ills of the present education system. Briefly, it has shown how the education system has become highly centralized, examination driven, joyless, impersonal, and utterly irrelevant to the child's world. The centralization deprives teachers of the freedom to organize teaching learning and meaningfully participate in the preparation of syllabi or textbooks. This in itself is bad enough, but now in addition to what is happening in India, it has become necessary to face the challenges of a rapidly changing world in the twenty-first century.

As the world shrinks on account of developments in science and technology, these changes affect Indian society (and other countries, too) increasingly in many different ways. The world today is a global village, and this represents unprecedented challenges for Indian Education. No society can live in isolation. This reality has a bearing on social processes in both the world as well as in India. This process has been going on for some time, but in the last ten years the pace at which the world is changing is becoming greatly accelerated. Some special features of this changing world are:

4.1 Knowledge Explosion

A decade ago, the knowledge base of humanity used to double every ten to twelve years; now it doubles every two to three years.[9]

Does this mean that there should be an even bigger load of material for children to learn? Or is there a way in which knowledge need not be served in different packages (as subjects) in schools? Is it possible

to weave knowledge in a multi-disciplinary fashion into questions that are of relevance and interest to the learners? Can we provide sources for learning that are more open than the traditional ones?

4.2 Technological Explosion, a Double-Edged Sword

A very important factor impelling change has been the technological explosion, particularly in the area of ICT (Information and Communication Technologies). Such technologies are double-edged swords. They allow people to contact one another and exchange ideas very easily in order to create communities built around common interests and common causes. They also make it possible for global corporations to move billions of dollars around the world with the click of a button. This gives them tremendous power over local and national economies, especially of Third World countries like India. Democratically elected national governments of Third World countries, even big ones like India, are no longer as sovereign as they were twenty years ago. With the profit motive reigning supreme, global corporations see human beings as consumers of their products and not as citizens with inalienable civic rights and duties. A byproduct of this phenomenon has been the loss of diversity in the biosphere, in cultural mores, and the ways in which we live. The world is becoming increasingly homogenized.

4.3 Homogenization of the World

The corporate world empire uses the tools of aggressive advertising and marketing campaigns and a centrally controlled media to turn around public opinion to support its agenda by means of what Noam Chomsky calls the "manufacturing of consent". As mass production leading to profits means mass consumption, global corporations like to disinvest the world societies of diversities and pluralities, something that India has always cherished and deeply valued. The more homogenized the communities of the world become, the more effective their media and marketing reach can be.

Multinational giants, therefore, pose a threat to diversities of both the environment and culture. The consumerism they help to promote a life-style in which wasteful ways that the Earth cannot support become the needs created by advertising. The scenario of competition leads to aggression and violence, which strip human beings of the essence of humanity, living in cooperation and harmony with others and with their surroundings.[10]

This attack of the global corporate empire needs to be met by teaching young people democratic values and equipping them with a sense of discernment so that they can choose the right way to build a better world. Open sources, which are now increasingly becoming available, can help break corporate monopolies. There is no end to the thirst of the corporate empire for power and control; it tries to use every means, fair and unfair (backed by the military might of the world's only super-power), to extend its

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[9] The UNESCO document- "ICTs in Teacher Education" records that 7,000 scientific and technical articles are published each day, and that the data sent by satellites orbiting the earth is large enough to fill 19 million volumes every two weeks.

[10] See Ariel Dorfman and Armand Mattelart, Para leer al Pato Donald*, translated into English and introduction by David Kunzle,* How to Read Donald Duck: Imperialist Ideology in the Disney Comic*, by David Kunzle New York: International General, c. 1975. Allende's Chile banned American comics that allegedly promoted capitalist values like one-upmanship as being destructive of Chile's culture. The Chilean government frowned upon the story of Donald Duck selling an island over which he had no claim. The ban, which created a furor in the American publishing industry, made sense in Allende's time. Now, of course, with satellite television any idea or visual can enter one's house against which the only weapon we have is to make our children develop ability to discern between what is right and what is wrong.*

reach in various ways. The latest thrust in this direction from the DPEP (District Primary Education Programme) sponsored by the World Bank has now become clear. Education has now fallen under the umbrella of the General Agreement on Trade in Services (GATS). According to GATS and the World Trade Organisation (WTO), education is a service, a marketable commodity. They have pushed the Indian government to accept this premise, and India is well on its way to participating in the WTO-controlled globalization of education.[11] The only way to preserve our secular democratic values and way of life is to ensure that our people are enabled to become stronger so that they can fight back this menace that will surely destroy the only habitat of life that we know, Earth. Already life has become worse on account of the crisis of potable water and environmental degradation.

There are several ways in which people are fighting back all over the world, and also in India. Two presentations made before the Focus Group were electrifying. One was from Pastapur, where multiply disadvantaged women (dalit, semi-literate or illiterate, poor farm labourers) from 70 villages, organized in Sanghams, have linked food security with many social and educational concerns, and have used ET as a weapon to attain equity, preserve human dignity, and achieve development. (See Appendix No. 5). The second presentation was about the work being done by a group of engineers from IIT Madras to provide technology that is both cheap and suited to Indian conditions to enable people to access information and better their lot in life. (See Appendix No. 7.)

These new technologies used in the right way can empower ordinary people, and ET can thus become a tool in this struggle that is taking place all around us. The Internet and the Web provide alternative sources of information and connectivity across the world to people who share similar interests and concerns. This could help in creating several power centres in the peripheries that would correct the imbalance of central rule in every sphere, including education. It would then become possible to look at knowledge not as something that comes from a central source, but that emanates from all around us.

4.4 Population Explosion

Another important factor behind change is the population explosion. Globally, population has increased several folds, but the strange fact is that while the population in the developed world is declining, it is increasing at a phenomenal rate in the developing world. A special demographic feature in India is that the country has one of the world's youngest populations. Furthermore, in the next decade, it is expected that over half of these young people will be below twenty years of age.

This number itself will pose an unprecedented challenge, and we have nowhere to look for a solution, as no country in the history of the world has ever had to face this problem.

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[11] *Sharad Chandra Behar (ed.). 2005.* Globalizing Education: Perceptions and Processes, *Indian Institute of Education, Pune. Prof. Arun Nigavekar, Chairman, UGC in his monograph* GATS and Higher Education: What is at Stake for India *records what happened to New Zealand after it accepted the terms of GATS. He writes, "New Zealand has opened up their education sector completely and without any restrictions. The belief that liberalizing trade in educational services would enable New Zealand's companies to expand on the vast global market proved to be wishful thinking. The protectionist attitude of the great powers, including USA and Japan, did not allow this to happen. Indeed, there is every danger that New Zealand may lose control over their educational system in favour of large transnational corporations." See pp. 14–15.*

Given our track record in bringing children to school, keeping them there, and attempting to provide them with a decent education, conventional solutions will not suffice.

It is a major challenge to provide large-scale access to all sections of children, including the 10 per cent or so who are disabled, especially when education must also be equitable and of good quality.

4.5 Scarcity of Resources

In the absence of assured access to alternative support materials—libraries, teaching aids, audio-visual material—textbooks have come to play a dominant role in the teaching-learning process. Textbooks combined with examinations, which test what has been memorized from textbooks, have exerted a stranglehold over the educational system in India; they have thwarted all attempts at curricular reform and have even undermined the goals of education. How can ET be harnessed to address these problems?

5. How can ET be used in today's context?

First, it is necessary to divest ourselves of the notion that ET means mass media or computers; no programme that is only equipment-driven works well. Our institutions have become the graveyards of a lot of useless equipment. We cannot afford to be as wasteful as we have been in the past, nor can we spend money on equipment without considering whether what we are buying is appropriate for the task at hand and whether the necessary support systems can be quickly set up.

We must also realise that knowledge springs from many sources, and that whatever is of importance in the learner's environment and suitable for his/her needs is what we must find and use in any teaching-learning system by employing effective instructional designs. Here considerable experimentation is necessary, and appropriate technologies for these designs will have to be worked out. The primary goal has to be an educational one. And to reach it, it might be necessary to tackle it by breaking it down into specific educational objectives. The same problem may exist in different localities and cultures.

The systems that ET specialists (teachers, parents, and educationists) would have to think about would therefore have to be diverse. Efficient teaching-learning systems at every level, which use available resources and appropriate technologies and processes, and which are flexible enough to effect changes based on observations and evaluations, are the need of the hour. Further, one should stop looking at knowledge as a packet to be delivered, and instead take up topics, at least at the earlier stages of the educational system, that are relevant to the child in his/her environment and let both teachers and children build a teaching-learning programme that is multidisciplinary. The saying of Jesus, "There are many mansions in my Father's house," is true in the case of ET systems as well.

The vast numbers of children who need to be brought under educational systems pose a problem of scalability. Here the new technologies and the mass media can help, but they must be woven into the system in such a manner that they give good results. Interactive rather than disseminative programmes are desirable. This expertise needs to be built up. The Internet and the Web provide sources other than local ones. But it is necessary to inculcate media awareness in our children so that they do not replace the words of tradition by the mantras of advertisers. They must know that nothing is value-free (not even Donald Duck).

The major responsibility for bringing about this change falls on the shoulders of teachers. The discipline

of ET is an enabling discipline designed to make the teaching of any subject more efficient and effective to meet the goals for which the subject is being taught. ET is not a subject in any syllabus except in teacher-training institutions. Information with respect to the ET needs of the curriculum have been passed on to the Focus Group on Teacher Education. Networking of teacher-training institutions and universities that offer ET courses is necessary.

Building alternative systems of education in addition to schools is the need of the hour. Whatever alternative systems exist on the ground need to be made less bureaucratic in their operations, and they should also be reoriented to carry out their tasks more efficiently. Alternative models of education, distance and open-learning models, on-demand education, and similar flexible models of learning will have to be tried and established. Flexible systems, futuristic curricula, and a twenty-first-century career orientation have become necessary for young people today. Conventional definitions of livelihood options are too limited to cater to such a large number of people.

6. The ET Focus Group's proposals for action

What are the things on which we could leverage? A vast number of institutions (almost 700) exist with ET components in one form or another—CIET, SIETs, state ET cells, SCERTs (State Councils of Educational Research and Training), and more than 450 District Institutes of Education and Training (DIETs). The Regional Institutes of Education (RIEs) of NCERT also have ET cells. Further, even in higher education, where it is recommended that teacher training in ET should form a part of their programme, there are media units. Under the University Grants Commission's (UGC's) Consortium of Educational Communication, we have a network of over 17 Educational Media Research Centre (EMRCs) and Audio Visual Research Centres (AVRCs). More that 250 universities offer ET as an optional subject in B.Ed.and M.Ed. courses. Technical Teachers Training Institutes (TTTIs)also have facilities for technical education. Several state open schools, the National Institute of Open Schooling (NIOS), several state open universities, the national open university, Indira Gandhi National Open University (IGNOU), and the distance education departments of conventional universities all have facilities to provide learning through alternative modes. However, all of them suffer from authoritative and exclusionary traditions. They must learn to collaborate, share, and revitalize themselves in order to meet the educational challenges that the future will bring. The Focus Group proposes that serious thought should be given to making these institutions more effective and to gear them towards the need of providing equitable and high-quality education with access to all.

6.1 Re-using Programmes for Interactivity

Many organizations like CIET, SIETs, AVRCs, and EMRCs as well as many institutions like the Tata Institute of Social Sciences (TISS), for instance, have made some excellent programmes. The numbers game in which organizations like SIETs are caught up prevents them from reusing their old programmes or the programmes of other institutions.[12] One of the most effective SIET

[12] *The HRD Ministry gives money for programming on the basis of Rs. 30,000 per programme. As SIETs are starved of funds, they prefer to make new programmes.*

has been Balchitravani in Maharashtra. It has a stock of nearly 3,000 programmes, many of which are of good quality. Starved of funds, it has been raising money by the sale of its programmes. It has made a profit of about Rs. 90 lakhs. Some of its programmes like "Get to know your trees" could easily be dubbed into different languages and used. The reorientation of such institutions, and bringing them under one network, is highly desirable. Many of the Balchitravani programmes need to be digitalized; otherwise they will be lost. The reorientation and strengthening of these institutions cannot happen if action is not taken on a war footing.

6.2 Information Collection

There is as yet no aggregating function assigned to any institution either for programming or collecting data in respect of innovations, or an assessment of their worth. Many institutions—whether at the district level, or the state level, or the central level—could consider taking on this role. Programming for built-in interactivity is the need of the hour.

6.3 Using Satellites, DTH, and other Technologies

Another technology worth exploring is the use of satellites. India is perhaps the only country with a satellite completely dedicated to education, the EDUSAT. The present configuration of its structure is at variance with its declared aim of reaching backward areas and marginalized populations. Nevertheless, it does free educationists from the dictates of Prasar Bharati, which, on the one hand, declares itself as a social service, but, on the other hand, demands money from educational programmers as if they are advertisers of commercial products. EDUSAT has a limited capacity for interactivity, but it would enable a new type of programming that is better than disseminative programming. Developing interactive skills and programming could be a valuable programme for ET, for which a great deal of R&D would be necessary.

It is desirable to explore whether an educational channel that uses the DTH (direct to home) technology of Doordarshan might not be a better proposition since it costs only Rs. 3,000 to install a dish antenna. It provides all the DD channels. DTH technology will have transmission capabilities both for Doordarshan (video) and AIR (audio) channels. These channels can become available anywhere in India. DTH also provides a number of free-to-air foreign channels similar to those offered by the BBC. This possibility should also be explored as a number of good documentaries on various subjects are available both in the public and private domains and could be shown on documentary or educational channels like the Discovery Channel.

Other resources that we have on the ground are a well-established publishing industry, desktop publishing, and know-how and capabilities in producing kits, teaching aids, etc. We have production capabilities for audio and video, multimedia, broadcast channels, Internet connectivity, trained manpower, and institutions with responsibilities to undertake the above-mentioned tasks.

If only we could start using these resources in efficient teaching-learning systems, we could achieve a great deal and show the way forward in providing large-scale access to all sections of children, even those out of school, and the disabled.

6.4 Specific Proposals for the School System

A paradigm shift has to be made regarding the notion of the teacher's role. She has to move from being a "teacher" to being a facilitator or guide. This means an emphasis on the learning culture rather than on the use of technology. One of the key concepts that should

be kept in mind here is flexibility, as the appropriate use of facilities and the achievement of growth would be impossible without it. We need to pay special attention to the continuing education of in-service teachers. Here are the suggestions that arose during the discussions:

6.4.1 Revitalising and reorienting existing resources

- At the risk of repeating ourselves, the Focus Group feels that it must emphasise that, while the macro attempts of the disseminative media have had limited effects, they have nevertheless led to the establishment of a large number of institutions and facilities, the founding of nationwide networks, and the emergence of trained professional and creative manpower in the area of ET. The challenge before us is to work out appropriate modes of re-engineering so that they can constitute a powerful and effective system.
- These institutions will have to play fresh roles. Apart from their role in producing audio and video materials, they will also have to be oriented towards action research, documentation, and assessment of innovative practices; undertake the in-service training of teachers; network with nationwide efforts in education and evaluation research; develop models for interactive classes, interactive multimedia, teleconferencing, and video conferencing; and lead the process whereby materials can be generated by teachers, parents, and children at every level.
- In recent years, ICT and the Internet have emerged as dependable media of interaction. Unlike the broadcast media, the Internet can facilitate the participation of the periphery in an eminently democratic discourse, which can be empowering. And if properly deployed, quality concerns hitherto forced by economic and power considerations to be confined to the haves can now be within the reach of everyone. The need of the hour is, therefore, to recognise this potential, promote universal access, facilitate participatory forums, and develop communities and interest groups. Left to market forces alone, the reach is bound to remain limited. The Internet can be a sound investment for continuous on-demand teacher training and support, research and content repositories, value-added distance education, and online campuses aimed at increasing the access, equity, and quality of education.
- The model of education prevalent today presumes the existence of groups endowed with abilities, knowledge, and skills, which at times even subsume the right values, and which therefore acquire the mandate to educate. This separation of the centre and the periphery has led to the alienation and disempowerment of large communities of people. The fact that we continue to invest in adult education, that we continue to grapple with the problem of dropouts, that we continue to deal with issues relating to the provision of even minimum facilities can be traced largely to this chasm. Both for logical reasons and as a moral compulsion, it has become necessary to strengthen multiple, albeit shifting, centres. The challenge of population alluded to earlier can only be met if we overcome this centre-dominant thinking.

- The other implication of this idea is that knowledge is not centred at any powerful location, but is available everywhere. What constitutes education is an opportunity for every individual to develop his or her latent abilities and skills, to choose his or her teachers, and to benefit from select experiences. The problems of certification and standardisation, recognition of what constitutes legitimate knowledge, deciding who is a legitimate teacher, and determining what abilities, knowledge, and skills constitute legitimate education may all have to be looked at from drastically different perspectives.

6.4.2 In systemic reforms

- Ensure that technology is used in an equitable and democratic manner to enhance the self-worth and self-image of the poor and the disadvantaged.
- Counter the tendency to centralise; promote plurality and diversity.
- Ensure opportunities for autonomous content generation by diverse communities.
- Shift focus from fixed to flexible curricula with competencies and skills identified rather than specific factual content.
- Deploy ET to enhance open education, which implies openness in curriculum transactions.
- Work towards transforming all schools into ICT-rich environments.
- Create opportunities for administrators and educational leaders in the school system to become ET savvy and to be able to use ICTs competently.

6.4.3 In refreshing the skills of in-service teachers

- Create a system of lifelong professional development and support, especially of educational leaders and managers such as headmasters and principals.
- Encourage ICT literacy for official and personal use to increase comfort and later enhance creativity in educational work.
- Support the development of and nurture teachers' self-help groups / professional development groups on the ground as well as online.

6.4.4 In pre-service teacher education

- Introduce teachers to flexible models of reaching curriculum goals.
- Introduce use of media and technology-enabled methods of learning, making it inherent and embedded in the teaching-learning process of teachers.
- Train teachers to evaluate and integrate available materials into the learning process.
- Enable trainee teachers to access sources of knowledge and to create knowledge.

The foremost challenge is to put in place a system of lifelong professional development and support. This has to replace the one-shot touch-and-go interaction, loaded with theory and almost no practice, into which the present teacher-preparation programmes have degenerated. Even while we set out to accomplish this goal, revamping the ET component of the course requires immediate attention. As long as ET is used in isolation from the other components related to teaching learning, it will fail to convince a teacher about the significance of her role in engineering the teaching-learning situation and the importance of making it a more meaningful experience for both herself and her pupils.

6.4.5 In school education

Move from a predetermined set of outcomes and skill sets to one that enables students to develop

explanatory reasoning and other higher-order skills.

- Enable students to access sources of knowledge, interpret them, and create knowledge rather than be passive users.
- Promote flexible models of curriculum transaction.
- Promote individual learning styles.
- Encourage use of flexible curriculum content, at least in primary education, and flexible models of evaluation.

Even within the confines of conventional schooling, helping children reach school and stay with it for a longer time will need to be addressed differently. Insights gained from various experiments aimed at reforming the school environment point towards the need for reform both in the system and within the classroom. ET will have a significant role to play here.

6.4.6 In research

- Create a framework to identify the generic skills (problem identification and troubleshooting, for instance) needed for the new initiatives to be undertaken in ET.
- Acquire knowledge about how learning takes place in ICT-rich learning environments, optimising learning paths for learners with different learning styles coming from a variety of social backgrounds, including gender differences. Examine possibilities of adopting mobile technologies for learning purposes.

7. POSSIBILITIES FOR THE FUTURE

Computers are programmable devices. This very fact makes it possible for users to make demands on these machines. This implies two things; first, that the computer ought to be capable of responding to intuitive demands, and second, that the user communicates in a language that the computer can interpret. Most software tools are designed with specific uses in mind. While this allows an ordinary user to concentrate on the task at hand, it is normally not flexible enough to respond to the different demands of the user. Most computer education programmes degenerate into teaching students the art of punching the right buttons, which ends up making them glorified data-entry operators. The need is, therefore, to seek an interface with the computer in order to respond to the user's creative needs. 'Open Source' shows a way to achieve this goal, providing access to the source code of software.[13]

The creative potential of the computer, and the liberating potential of the Internet, can only be unleashed when we actively make these kinds of demands of these technologies. The students of the future should be oriented to this possibility, allowing them to stand their ground amidst the technology-mediated onslaughts of the modern world. Integrating ICT into education will require that these aspects of the technology are catered to as a whole.

Hitherto we have used the media to pick up or beam out information depending on where we stood in the teaching-learning spectrum. Today, as learners, we can use the media to personalize our questions and to find the answers to our own questions as a matter of choice. As teachers, we can find out what intrigues our learners and we can orient our approaches accordingly. Institutions with the ET agenda will now

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[13] The code used by the software to communicate the user's interaction, say by the click of the mouse button on a specific icon, to the computer in order to elicit a specific response; usually written in a programming language.

have to be on the look out to attract people and projects, functioning somewhat like lighthouses. They have to learn that their role is akin to that of an observatory or test-bed where new trends are sighted and experimented with. If they do not do this, they will either be frozen or become rusted like the machines in many such institutions, of no use to anyone except to those with vested interests.

The different Focus Groups involved in this exercise are deeply concerned about the ways in which education could be made more meaningful and joyful and how it should be designed in accordance with the learning pace and potential of children in a rapidly changing world. Education will continue to face the challenges of numbers, limited finances, knowledge explosion, corporate globalization, and the politics of power globally and locally; will continue to haunt education unless we can find a way out of this quagmire.

Appendix 1

Bhandup Municipal School Project, Mumbai

The Bhandup Municipal School Project is the brainchild of Dr. Kusum Kamat, who retired as the Education Officer of the Mumbai Mahanagar Palika. The children in municipal schools are almost always from the marginalized classes. Knowing their difficulties, Dr.Kamat wanted to enable teachers to provide education that is multilevel, multi=graded, cooperative, and fun. This, she thought, would be possible if teachers could become educational technologists, assess the needs of each individual child, and induce the student to learn at his/her own pace, moving up to higher skills after mastering lower-skill tasks, and cooperate with other teachers and children. To test her ideas, two municipal schools in the Bhandup slum area in Mumbai were taken up as pilot experimental schools for which CASP-PLAN gave her some seed money. These schools had 2,000 children in Classes I–IV, and 38 teachers.

After assessing the different problems faced by these children in respect of their homes, parental illiteracy, poverty, health problems, irregular attendance, and low achievement, Dr Kamat looked at the problems faced by teachers. These related to large classes, with different achievement levels of children, irregular attendance, lack of interest in schooling (on the part of both parents and children), and the absence of refresher courses for teachers. Dr Kamat believed that it was important to make teachers understand that even low achievers could become good students, that education could be made interesting, and that the learning pace should be set to suit the level of each child. If parents found that their wards were doing better at school, their cooperation would come in time. The teacher's role was, therefore, pivotal. How to make the teacher a facilitator, manager, and organizer of instruction was the crux of the problem. Learning materials were necessary; they had to be made available at a low-cost or no-cost basis, because if the project was to be worthy of replication extra money could be provided.

Dr Kamat's teacher-training programme aimed at improving the understanding and efficiency of teachers and sought to make them identify learning sources/experiences in keeping with the needs of pupils and their individual talents and personalities; teachers had to ensure that the children developed self-learning skills. It was necessary to prepare diagnostic tests to plan remedial measures, learn to organize learning situations to facilitate the active participation of learners, and plan/organize activities for students in such a way that they would be given opportunities to showcase their talents, increase their interest in learning, and make them feel confident. Other important goals were to establish a rapport with parents, find solutions to improve school attendance, seek the cooperation of parents and the community in organising school activities, and cultivate the interest of parents in the academic performance of their wards.

Once teachers understood that steps such as multigraded learning, the freedom to move

about in class, and multilevel materials designed to suit the needs of children all help in making children learn better, both they and the children began enjoying what they were doing. The municipal corporation agreed to free teachers from teaching duties on Saturdays (which was, in any case, half a school day) so that teachers could spend their time in planning the next week's lessons and prepare materials. Students often brought waste material like bus tickets and empty cartons and matchboxes to school, which the teachers then used to make these materials. At the pilot stage, some money was needed for teacher training. But later when the pilot became replicable and was introduced from two schools to many more schools, it became possible to provide such training within the normal budgets of schools. The training consisted in exposing teachers to new techniques by way of demonstrations by resource persons and experts, visits, seminars, and conferences. They were given scope to experiment with new methods and report their findings to others at seminars. This kind of planning, interaction, and exposure helped teachers to solve their own problems. The evaluation showed that teachers were enthusiastic, children were learning, attendance had improved, and parental cooperation was more forthcoming.

After evaluating the programme, certain changes were made. It was then decided to extend the programme to 18 more schools. These had 165 teachers and 8,500 pupils. In this phase, too, the programme worked quite well and showed good results. The municipal administration then took over the programme and extended it to many more schools. But its vision was limited to the more traditional types of teaching. Further, there was more emphasis on cognitive learning. The training unit staff was also not able to train teachers independently. At the end of the first year, it was noticed that teachers were not motivated to change. During the last phase, a multimedia package of textual materials and video programmes for training purposes was developed. This package has helped experts to reach teachers independently of those organizations that are in charge of elementary education. The package is now widely used in the DPEP programme and in those districts of Maharashtra where the district education officers are interested in helping to bring about a change in the educational system.

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Appendix 2
Gram Mangal Project, Maharashtra

The Gram Mangal project, established in 1982, works in the adivasi belt of Maharashtra that borders on Gujarat. When Anutai Wagh, who had worked for a long time with Tarabai Modak and Dr Ramesh Panse, first came to the area, there was no drinking water, no electricity, and no roads, let alone a school. The adivasis were very poor, and the two social activists realized that unless the villages become self-reliant communities, by undertaking development programmes, there was no way that conditions would improve. They started many development activities, and later also concentrated on early childhood education as part of the development programme. After working for three years on getting basic amenities like drinking water and roads, they began working on the educational programme.

Gram Mangal does not take any grants from the government, but supports all useful activities that the government undertakes in the area. They also work in collaboration with other NGOs The organisation is supported by the larger community. Their educational efforts are concentrated on vikaswadis, teacher-training programmes, health care programmes, and technical/vocational education programmes. Gram Mangal also undertakes research programmes. They now have several vikaswadis in nine villages.

The curriculum is child-centric and related to the adivasi child's environment. In the early years, the local Warli language is used and later Marathi is introduced. A lot of educational material, both locally prepared and bought from elsewhere, is used. Gram Mangal also maintains a bank of educational materials.

This project as well as the Pastapur project illustrate the need to forge close links between development and education.

More information
http://www.grammangal.org/

Appendix 3
Avehi Abacus Project

The Focus Group paper talks about the need to build knowledge content for young children in a multidisciplinary mode around what is relevant to a child. Those who support the tradition of imparting knowledge in terms of subjects may like to look at the way an NGO has organised this.

Shanta Gandhi, who had been engaged for a long time in early education and Bal Bhawan work, conceived the idea of Abacus in 1952, when she was working in village Nikora on the banks of the Narmada. She began by seeking answers to the questions of adivasi and non-adivasi children relating to their surroundings, primarily through drama and song. She began discussing various themes and topics like evolution, how life emerged, why we are what we are, and how we have reached here. In 1981, Avehi, an audio-visual research centre, was launched. In 1990, Avehi took up the Abacus programme in Mumbai and operates its programme using developing learning materials in 180 schools in two wards of the Mumbai Municipal Corporation. The materials developed are predominately visual and very attractive, and are welcomed by both teachers and students as the schools are located in slum areas and have no libraries. These are meant for students in Classes V and VI, and appear in the eight languages used in these schools. The programme also operates in 100 schools in Chandrapur and Yavatmal districts.

The materials are thematic and arranged around the following topics:

- Myself, my body, and our needs. Understanding that I am unique, but so is every one of us. Still we share common needs, so we are interconnected. Understanding the world and the web of life. This helps in understanding that the earth fulfils all our needs and that our life binds us together, both the living and the non-living. How do societies develop? Where have we come from? This helps in understanding who we are and the mechanisms that bring people together. Understanding society and its structures.
- The way we live and where we are today. What are the roles of social institutions like the family, the state, class and caste? What roles do they play in our lives? How relevant are they? How do they influence us? Having understood the importance of these institutions, what do we accept, or reject, or challenge?
- Exploring change. Change is inevitable. We can either be passive and react to the change once it happens, or if we understand change, we can learn how to be proactive, and hasten a change that is good or resist a change that is unwelcome.
- Where are we going? What do I want in life? What will I be encouraged to do? What will take me further? What will determine my future and the future of the world around me?

The organisation running Avehi Abacus Project consciously works with the system and uses the existing space and SUPW (Socially Useful Productive Work) time to address these themes

during one-hour sessions. The first 10–15 minutes of the session are spent in introducing an idea through a story or flip chart. Then there is discussion or activity to connect what has been discussed to the lives of the students. This may involve group activity or worksheets. These activities emphasise values such as working together, respecting each other and the dignity of others, respecting labour and all living things, and working for peace. Children debate and discuss the issues and come up with solutions.

More information
http://www.avehi.org

Appendix 4
In-service Teachers' Training through the Multi-media Approach (SITE)

Organised by the Centre for Educational Technology (CET), NCERT in 1975–76

Educational objective: Show teachers that "Science by Doing" is a good method for teaching science, and get them to practise it.

Educational problem: The Science Department of NCERT had launched the programme to introduce science from Class III, but primary schoolteachers—numbering about 1.6 lakhs—did not have much idea about how this could be done. The summer courses organised for this purpose could not reach such a vast number of teachers quickly.

The availability of the ATS-6 communication satellite loaned for a year by the USA to India made it possible to beam television broadcasts to backward areas. About 2,400 villages in backward areas in six states were equipped with electricity and television sets. However, as the one-way telecast of a 22-minutes programme was hardly adequate to the task of bringing about attitudinal change, it was decided that though the telecast would be used as a novelty and for providing materials that were not easily available, the training programme would consist of multi-media in the form of textual materials, activities for illustrating how "Science by Doing" can be taught (the real mainstay of the programme), radio programmes, and radio-vision programmes. Interactivity was also essential. This was provided by having a facilitator (a high-school science teacher who had received orientation in the multi-media package). Each medium was designed to fulfill the special task assigned to it in the instructional design of the course. All the materials were translated into the various languages of the region and made available. Fail-safe alternative materials (in case the telecast failed on account of the vagaries of electricity supply) were also prepared.

Ten teachers from the villages surrounding a television village were invited to attend a two-week course at every television village. Evaluation teams from CET sampled the attitudes and knowledge of teachers prior to the beginning of the course. There were summative evaluations as well.[14] The deficiencies noted were rectified in the second course. This time the course time was increased from 10 to 13 days, and two groups and two teacher-facilitators worked in 1,200 television villages. More activities were added. Similar formative and summative evaluations were done. Before the satellite footprint was drawn back from India, nearly 48,000 teachers were trained in one year. The course was considered to have been successful in reaching its objectives as CET and SCERTs kept on getting letters from teachers asking for information. A study of the retention of attitudes and practices was done six months later, and it was found that a large number of teachers were teaching "Science by Doing". Where they did not do so, it was more on account of administrative failure than the teachers' unwillingness. Many states continued to use the materials even after the telecast was discontinued.

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[14] *Studies by Snehalata S., Jagdish Singh, and Suresh Batra of CET, and Simon Maxwell of UNDP.*

Appendix 5
Using Radio in an Interactive Mode

The use of radio broadcasts in multi-media mode (viz., textual materials, interventions by teachers) was undertaken earlier (viz., in teaching Hindi as the first language to children in Rajasthan, or to children in Madhya Pradesh who used a variant of Hindi as their mother tongue). But in recent years, several programmes using radio in the interactive mode have been undertaken. Radio has many plus points: first, making audio programmes for both broadcast and non-broadcast modes is a much cheaper proposition than making video programmes; second, audio is very suitable for language learning; and third, given the erratic power supply in urban and rural India, battery-operated radios work quite well.

The Centre is running one such programme for Learning Resources (CLR) of Pune for teaching English to Classes V, VI, and VII. Approximately 85 radio lessons, each of 15-minute duration, have been broadcast since 2001, three times a week, using AIR as the conveyer. These programmes were first broadcast to all urban and rural schools in Pune district. Since 2004, the programmes are being broadcast to municipal schools in Mumbai. The Hindi–English version of these programmes is being used in Classes IV and V of the municipal primary schools in Delhi. Since 2003, the programme has also been extended to Jharkhand for Classes IV, V, and VI. The same programme is broadcast once in the morning and once in the afternoon.

The programme provides pauses for teachers and children to respond. It gives opportunities to children during the lesson to speak in English and a variety of child-friendly formats such as song, drama, and language games are used. The lessons also promote democratic values.

Comparative studies show that, after listening to 90 radio lessons, children spoke far more English than Class VII students of the same school who had not been exposed to the programme. After three years of radio interventions, rural students from Class VII spoke far more English and wrote better English than rural students from Class IX who had not been exposed to the lessons. Teachers have been quite appreciative of these efforts.

Keli-Kali Radio Programme in Karnataka (Government of Karnataka, AIR)

The Keli-Kali radio project was initiated in 2000–01 in two districts (Raichur and Gulbarga) of North Karnataka to provide support to classroom teaching. About 2,50,000 Class III students in 5,000 schools benefited from the broadcast aimed from two radios stations. The process of the development of the radio lessons involved the following steps:

1. Identification of hard spots;
2. Teachers' training in script development;
3. Development of scripts and editing;
4. Production of programmes by AIR;

5. Preparation of teachers' handbooks and orientation of Block Resource Centres (BRCs) and Cluster Resource Centres (CRCs);
6. Training of all teachers by BRCs and CRCs;
7. Provision of funding by the state government for the purchase of radio sets,-RCCPs (Radio-cum-Cassette Players) and dry cells;
8. Discussion in CRCs meetings about stocktaking, reporting, and sorting out problems relating to ensuring the listening of the radio lessons;
9. Organization of audio-conferencing with teachers and BRCs/CRCs for getting feedback;
10. Documentation and research to determine the effectiveness of the project.

In 2001–02, the project was extended to 13 districts covering students of Classes III and IV in about 14,780 schools. In 2002–03, the project was extended to Class V and covered 49,640 schools. In all, 258 lessons relating to EVS, Kannada, and mathematics were broadcast. In 2004–05, the project was extended to Class VI.

Radio Broadcasts in Andhra Pradesh and Himachal Pradesh

"Vindam Nerchukundam" (Let us listen, let us learn) in Andhra Pradesh, similar to the Keli Kali programme, was begun in Vishakapatnam in 2002 for Class III students. In 2003, it was extended to Class IV and in 2004, to Class V. The programmes were broadcast from four AIR stations. The programmes benefited about 29 lakh students and 1.5 lakh teachers.

Similarly, in Himachal Pradesh, a radio broadcast entitled "Gyankalash" was initiated in 2000 for students of Classes I–V during the evening hours.

Interactive Radio Instruction in Karnataka, Chattisgarh, Jharkhand, and Madhya Pradesh

The Interactive Radio Instruction (IRI) programme is a USAID-funded project and organised by the Educational Development Centre (EDC). It is similar to Keli Kali, but included interactivity during the programme. It was implemented in 2004–05 in two blocks (50 schools in each block) of North Karnataka, and 72 schools of Bangalore and Chamarajnagar district. In contrast to Keli-Kali, in the IRI programme experts developed the master plan and scripts after holding discussions with teachers. Private production agencies did the production work. Programmes were subjected to formative evaluations. The multigrade approach was adopted and was aimed at Class IV and V students. A strong research component (pre- and post-test designs with qualitative data from schools) was included. The subjects covered were science, social science, and mathematics. A total of 72 audio programmes have been developed.

Almost all the steps followed in the IRI programme of Karnataka have also been followed in Chattisgarh and Jharkhand. However, the radio broadcast is meant for Class I and II students. Three blocks are covered in each state. The programme began in 2004–05. Radio sets were supplied by EDC. In Chattisgarh, a total of 115 programmes will be broadcast by 15 March 2005. In Jharkhand, a total of 86 programmes will be broadcast. Twenty-eight audio programmes are being broadcast during this year in Madhya Pradesh.

Appendix 6
Enabling People through Educational Technology: The Pastapur Effort

The Deccan Development Society (DDS), based in Hyderabad, is a two-decade-old grass-roots organisation working with women's sSanghams (voluntary village-level associations of the poor) in about 75 villages around Zaheerabad in Medak district of Andhra Pradesh. The 5,000 women members of DDS represent the poorest of the poor in their village communities. Most of them are dalits. DDS has a vision of consolidating these villages into vibrant organs of primary local governance, and federate them into a strong pressure lobby for women, the poor, and dalits. This vision is being translated into reality through continuing dialogues, debates, and educational and other activities with the people, facilitated by DDS.

Over the years, the programmes have evolved from meeting the simple sustenance needs of sangham members to empowering them so that they can address the larger issues of food security, natural resource enhancement, and the education and health needs of the region. The integration of various activities is intended to retrieve women's natural leadership positions in their communities and to fight their lack of access to control over their own resources. These activities, alongside ensuring earth care and preserving useful traditional knowledge, have also resulted in human care by giving the women a new-found sense of dignity and public profile in their village communities.

The activities of DDS have assumed various forms, which centre around the principle of autonomy of the local community—autonomy over food production, autonomy over seeds, autonomy over natural resources and their management, autonomous markets, and autonomous media.

The initiative aimed at autonomous media is particularly relevant in the context of the Focus Group's suggestions. Transcending the barriers of non-literacy, the DDS women's groups have successfully produced videos to conduct a dialogue with their sanghams and inform the outside world of the accomplishments of their fellow members. A stunning film, "Why Warangal farmers do not like BT Cotton", on the ills of genetically modified cotton seeds, produced by these women, has been showcased around the world. Their compelling statements on why they should have media of their own is forcing the academic and development world to rethink media policies. The women have also established a Community FM Radio Facility, controlled and operated by them. Grouping themselves into a rural women's media collective, the DDS Community Media Trust, the women have been taking up social issues and concerns, video-documenting their findings, with their own original perspectives. These films have been featured in many international

meets, and the group has worked with international organisations in training similar women's communities in Third World countries like Bangladesh, Sri Lanka, Pakistan, and Peru.

DDS also runs Paccheshale, an alternative school, and the sanghams run 40 balwadis. Speaking to the women, one realises the power and autonomy unleashed in the minds of these individuals; their work showcases an alternative way in which education and development can be thought of, as something that is not bogged down by narrow definitions revolving around literacy.

More information
http://www.ddsindia.com

Appendix 7
Internet Connectivity for Indian Villages

The TeNet group of IIT Madras along with n-logue communications pvt. ltd., Chennai has a commitment to provide Internet connectivity in the villages of India, and use that facility to drive education, health, and livelihood in the connected villages. It uses indigenously developed corDECT wireless technology to provide connectivity to a village. It finds a local entrepreneur in each village and helps him/her to set up a low-cost Internet kiosk and provide services in these villages. The total cost of the kiosk is Rs. 50,000, which includes wireless connectivity, computer, printer, power back=up, camera, and local language software as well as the cost of training the kiosk operator and six months' unlimited Internet charges. The operator needs to earn Rs. 3,500 every month to break even. The kiosk provides multiple services to the village in order to earn this sum. Today n-logue has over 2,000 kiosks in about 30 districts in different states.

One of the main services provided by the kiosk is educational. In addition to providing computer training and offering courses at various levels, including utility courses such as "how to make a bio-data" and "how to take good photographs", a major area of emphasis has been coaching children to pass the SSLC examinations, especially in subjects like English, science, and mathematics. Online courses are aimed at children seeking to learn the subjects, practice for the exams, and also take mock tests (which are graded) to prepare for the SSLC exams. In addition, some online live video lectures (with interactivity) are provided with the aim of putting some of the best teachers in front of rural children. At the same time, in response to popular demand a course on spoken English is being run for rural children, and this has proved to be very popular. The group is very conscious of the fact that education in rural areas through Internet kiosks is in its infancy, and that it needs to do much more to advance this project.

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Appendix 8
The Hole in the Wall: Demystifying Computers

Children learn to use computers quickly if they are allowed to play with them. Dr Sugata Mitra of NIIT was surprised to see how rapidly his six-year-old son learnt the operations of the computer just by watching his father. This insight led Dr Mitra and his colleagues to build a computer into a wall near their office in Delhi. The monitor screen was visible from the other side of the wall. They also embedded a touch pad into the wall. Children came running out of the nearest slum and stuck to the window like glue. A few hours later, Dr Mitra and his colleagues found that the children were surfing the Net. Within a period of six months, the children had taught themselves many computer operations. How did they do this?

Dr Mitra observes that in playing with the pad and the mouse, an accidental discovery is made. Say the cursor changes into a hand-shaped icon when a child hits the graphical users' surface. Others repeat this by learning from the first child. Most of their learning is through such discoveries; they verbalize it in their own way. This vocabulary encourages them to perceive generalizations, for example, "When you click on a hand-shaped cursor, it changes to the hourglass shape for a while and a new page comes up." They memorise entire procedures for doing something, for example, how to open a painting programme and retrieve a saved picture. They teach each other new and shorter procedures for doing the same thing whenever one of them finds such a shortcut. The group divides itself into the "knows" and the "know-nots". However, they realise that a child who knows will part with that knowledge in return for friendship and exchange of information as opposed to fighting over the ownership of physical things, where they would use force to get what they did not have. A stage is reached when no further discoveries are left to be made, and the children occupy themselves with practising what they have already learned. At this point, intervention is required to introduce a new "seed" discovery ("Did you know that computers can play music? Here, let me play a song for you."). Usually a spiral of discoveries follows and another cycle of self-instruction begins.

Within the next six months, the children of the neighbourhood had learned, mostly on their own, all the mouse operations; they could open and close programmes, and surf the Internet and download games, music, and video. When asked how they had learned to do all these operations, they said that they had taught themselves. They described the computer in their own language, often coining words to explain what they saw on screen. The hourglass symbol was "damru"; the mouse cursor was; "sui" (needle) or "teer" (arrow). The media gave this experiment considerable publicity. Dr. Mitra and his colleagues at NIIT call it Minimal Invasive Education (MIE). The media described it as the Hole in the Wall. That name has stuck.

Funding and requests for information came from different governments. The programme is now operating in several places in Delhi, Madhya Pradesh, Maharashtra, and even Cambodia.

The funding has helped in trying out the experiment in diverse human and climatic conditions. Wherever they found an appropriate place and a friendly panchayat or school, the NIIT engineers built a little structure with three computers facing the road. This plan is now the standard design for the Hole in the Wall project. To overcome the problems of dust, erratic power supply, the threat of adults taking over the experiment, etc., a number of modifications were made. The NIIT people are confident that their computers would work anywhere. If a computer goes into the hang mode in a remote village in Kanyakumari, NIIT engineers can solve the problem because the NIIT software enables NIIT scientists to "see" their computers from anywhere through the Internet. Their new software ensures that nothing can be deleted, even by accident. By keeping the window (the "hole") in the wall low to the ground, adults are prevented from using the computers. Observations were made in 26 locations, with 100 computers placed in remote villages. Focus groups were tested for nine months, and the results compared with those yielded by control groups and other frequent users. An estimated 40,000 children use these computers. They have all made themselves computer literate. The average icon test scores stand at 40 per cent in nine months. Dr Mitra and his colleagues now have proof of effectiveness of self-regulated learning, and are confident that such learning can happen anywhere in the world, to any child, in any climate. Egypt and South Africa have now borrowed this learning methodology.

Dr Mitra says that groups of six- to thirteen-year-old children do not need to be "taught" how to use computers. They can learn by themselves. Their ability to do so seems to be independent of their social, economic, and educational background, literacy levels in the English language or any other language, ethnicity and place of origin, i.e. city, town or village, sex, etc. Surfing of pornographic websites by the children is quite rare. Teachers have often recorded gains in enrolment, attendance, and school examinations, particularly in subjects that deal with computing skills, English vocabulary and usage, concentration and attention span, problem-solving skills, and, above all, in working together and exhibiting self-regulation.

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Appendix 9
Computer Education Initiatives

This sector has more or less remained outside the institutional framework. Although universities and accrediting agencies have stepped in to bring about a level of standardisation, two features of this new technology have defied all attempts at stability. As a technology, it is one of the most rapidly changing ones, requiring drastic upheavals in basic understanding. Time scales have shrunk. The second aspect of this technology is the impetus it provides to a variety of applications in a diverse market, creating jobs that were hitherto unheard of. Makers, users, marketers, and a host of service providers have found avenues of employment both in India and abroad. This in turn has catalysed the inflow of capital, fuelling an upsurge in infrastructure and services.

India, having taken an early initiative in the area, has emerged as a leader in the IT arena. Conventional regimes of setting up and running courses cannot meet the demands of this job market. Led by a few private initiatives such as NIIT and Aptech, a number of institutions offer an enormous range of short- and long-term courses, rapidly responding to changing technologies and market trends. The inbuilt openness of the system that they have evolved has also allowed professionals to keep pace with modern trends, re-skilling themselves in specialised hardware, software, and applications. The courses themselves are at different levels, enabling both the novice user of software applications and the expert programmer to pick and choose. The Internet and the publishing industry have also pitched in, making available one of the largest and most regularly updated libraries; accessible to anyone who desires to benefit from it.

The computer education industry has demonstrated an ability to respond rapidly to changing needs, setting up need-based courses, offering skill-based certification mechanisms, generating peer tutors and teachers, all of which may have implications for education in other spheres as well, especially in light of our attempts to provide education for all.

Corporate Initiatives in ICT for Schools

Recognising the immense potential of ICT as a job market, many state governments have taken initiatives to introduce students, especially those in high schools, to computer education. Some of these initiatives have gone beyond providing basic computer literacy, and are trying to integrate computers into education as well. While it is too early to attempt any meaningful impact assessment, heightened levels of interest and innovation are discernible. A variety of private sector–government partnerships have been tried and a large number of corporate houses and NGOs are participating in these. Some of these initiatives are described below.

Technology Initiatives by the Azim Premji Foundation

A combination of aspirations, desires, and perceived benefits resulted in over 10,000 elementary schools in India having access to computers. While this achievement contributed to heightened

expectations, the lack of appropriate content for children in the local language had a dampening effect on the effective utilization of these computers. The Azim Premji Foundation has begun creating content on CDs to meet this requirement. Keeping the child as the main player in the story, the CDs aim to attract and retain the interest of children in learning through the medium of animated cartoons. Forty-minute-long modules in the local language, with options in English and Hindi, have been created to make Learning Play and Assessment Fun. The modules relate to competencies that the child is taught in school like language, mathematics, and science, and co-curricular topics (like fan, telephone, and television) to expose the child to the urban environment. These modules are used as supplements to classroom teaching. To facilitate the effective use of this content in the schools, a detailed training programme for teachers on computer-aided learning package was developed and conducted in partnership with state governments.

As of January 2005, there are 69 titles for children in Classes I–VIII. Each title has three language options: regional language, national language Hindi, and international language English. The content is available in eight languages: Kannada (64); Telugu (42); Tamil (35); Urdu (18); Oriya (6); Gujarati (4); Gurmukhi (3); and Malayalam (1). Children in over 4,600 schools are using these titles across the states in India.

Mahiti Sindhu Programme in Karnataka

The Mahiti Sindhu programme was initiated in Karnataka in 2000, and is being implemented in about 1,000 secondary schools. The state government pays three institutions (NIIT, Aptech, and EDUCOM), which in turn take up the responsibility of training teachers and maintaining computers in schools. Each class gets four periods per week. Schools with fewer than 150 students got five computers with one server; schools with 150–250 students got nine computers with one server; and schools with 250–500 students were provided with 14 systems. Subject-based CDs were supplied by the agencies. The project evaluation is being carried out by an outside agency.

Similar initiatives are also being taken in the schools of Andhra Pradesh, Kerala, Delhi, Madhya Pradesh, and Chattisgarh.

Head Start Programme in Madhya Pradesh

The computer-aided learning programme in Madhya Pradesh was introduced three years ago. Now there are 2,718 schools covered under the Head Start programme. Each school has been given a minimum of three systems, with backup power of three hours. The centres are located in cluster centres (housed in primary school buildings). The CDs are developed by the Rajiv Gandhi Shiksha Mission, Bhopal and distributed to all the schools. The programmes are developed on the hard spots identified by the teachers. The mission has trained the teachers of these schools in using the CDs effectively in the classroom. The topics cover all the subjects being taught in schools, including science, mathematics, social science, English, and Hindi. The programme is interactive in

nature, and has an inbuilt self-evaluation system. Research conducted recently shows significant gains in mathematics, followed by science, social science, English, and Hindi.

Computer-Aided Instruction in Kerala

The IT @ School Project was started in Kerala as a computer-aided instruction project in 2003 for the benefit of Class VIII students. During the last two years, the project has been extended to Classes IX and X. Kerala has developed the syllabus for computer education. This project is being implemented in about 2,735 schools. About 25,700 computer systems have been provided. Three students share one system. Of the allotted four hours per week, two hours are spent on theory classes and two hours on practical assignments. Students take online examinations. The funding for this project has come from different sources, including the development funds of MPs and MLAs. So far, about Rs. 18 crore have been spent. Each student is charged not more than Rs. 25 per month, and in the case of SC/ST students the state reimburses the amount.

Maharashtra Knowledge Corporation Limited (MKCL)

The Higher and Technical Education Department (HTED), Government of Maharashtra appointed the Professor Ram Takwale Committee in January 2000 to offer recommendations regarding the universalisation and integration of IT in all the institutions dedicated to higher and technical education in the state. The committee submitted its report to the government on 25 April 2000. It recommended the creation of a special-purpose agency, viz., the Maharashtra Knowledge Corporation Limited (MKCL), for the speedy, effective, and self-supporting universalisation and integration of IT in higher and technical education in the state. The government appointed a Special Working Group to implement the recommendations of the committee.

A unique partnership arrangement where individuals, organisations, both private and government, and educational institutions participate as equals has been initiated. The flag-ship course of the corporation, the MS-CIT (Maharashtra State Certification in Information Technology) programme, is a joint venture of HTED; it trained providers initially in about 425 different educational institutions, i.e. in ITIs; arts, science, commerce, law, and B.Ed. colleges; engineering colleges and polytechnics, etc. MKCL is also venturing into the development of other courses, one of them being the teaching of English in schools, for which SNDT Women's University, Mumbai is developing multimedia materials.

MKCL aims to develop into a world-class, globally competitive, flexible, and value-based educational system that is responsive to the individual, institutional, and social development needs of the people of Maharashtra and India. The mission of the corporation is to integrate, in a self-sustainable manner, IT education and IT-enabled education into basic teaching, the learning process, and management so as to achieve the goal of preparing graduates for the knowledge-based economy of the twenty-first century, champion the cause of lifelong learning, and stimulate the creation of world-class resources through IT.

Intel Corporation's Teach to the Future Programme

The Intel Corporation has initiated a programme of computer-aided instruction in coordination with 12 state governments, the Kendriya Vidyalaya Sanghatan, and the Navodaya Vidyalaya Samiti. The programme aims at a professional development programme for in-service and pre-service teachers. The course helps teachers use technology in support of project-based learning and to encourage active inquiry and higher-order thinking. Participating teachers receive extensive training as well as resources incorporating the Internet, multimedia, and assessment tools aligned with the local board curriculum framework. More than 4,00,000 teachers have been trained since the programme began in February 2000 in India. Apart from this direct initiative involving computer education, Intel has also started a National Science Fair aimed at infusing the discovery among school-children and increasing their interest in science and mathematics. It allows students to improve their scientific aptitude, and experiment with everyday problems and find scientific solutions to them. It is a platform for Indian students to showcase their talent and win public recognition and awards. Intel affiliates with various state government science exhibitions/fairs and selects two projects from each state for the national fair every year, providing an opportunity to government school students to compete at the national and international levels. Intel India has joined hands with a few educational and social institutions in the country for supporting community needs; this includes a Technology Training Centre at Bharatiya Vidya Bhavan, Hyderabad to provide job-oriented training to students and unemployed youth; the Cyberskool Programme, started in association with the National Council of Science Museums, aimed at providing training to people who do not have easy access to IT; and a Technology Training Lab at the National Association for the Blind, New Delhi, which offers basic courses in computer usage and screen-reading software for the visually impaired.

Microsoft's Project Shiksha

According to Microsoft Corporation India, Project Shiksha aims to accelerate computer literacy in India by providing a comprehensive programme that includes software solutions, comprehensive training for teachers and students, development of a world-class IT curriculum, and scholarships for teachers and students. Teachers are exposed to an IT literacy curriculum with the key objective that they will return to the classroom and use IT interventions in their teaching. Over 80,000 schoolteachers and 3.5 million students across government schools will have an opportunity to strengthen their IT proficiency through this initiative over the next five years.

Launched in Dehradun, Uttaranchal and in the training hubs of the Navodaya Vidyalaya Samiti(NVS), Schools the project has MoUs with the states of Maharashtra, Madhya Pradesh, Andhra Pradesh, Karnataka, West Bengal, and Uttaranchal. Microsoft Corporation India is also running a programme for the teachers of the Municipal Corporation of Delhi (MCD) and the Army Public Schools through Project Shiksha.

Learnings from the Projects

While computer education appears to have been taken quite seriously by many state governments and by certain private sector initiatives, most of these programmes are aimed at preparing students for the job market. In addition, the programmes are software-centric, i.e. they emphasise the learning of a specific set of software tools. There is an urgent need to demystify this technology[15] and de-emphasise the learning of specific tools. A balanced generic curriculum, where computers are relegated to their due place as tools, and where they extend the horizons of other subjects, is a must. The availability of appropriate software in Indian languages, and in adequate numbers, will catalyse this process.

[15] *As the children using the Hole in the Wall have demonstrated, and as the chairperson of this Focus Group has also demonstrated (who learned to use computers and the Internet well past her eightieth year without much effort), the hype about teaching people to use computers is unnecessary.*