Learning Curve

A newsletter from Azim Premji Foundation

Azim Premji Foundation

From Azim Premji Foundation

Recently I participated in a discussion that centered on accountability of the school and the education system to ensure quality education in government schools. Shorn of all the frills, what the group debated and seemed to agree on was:

• Teachers, the Parent Teacher Association (or the School Development Monitoring Committee) and the parents are three gears of a school system that must mesh smoothly. The Head Teacher is the key driver in this system. The largest and most significant gear is the school teacher and even if the other two gears are disengaged, the school will still manage to deliver if the teacher is motivated and committed. However, if the School Development and Monitoring Committee and the parent gears are in counter movement, they can bring even the committed school teacher 'gear' to a grinding halt. This is at a micro or unit level of accountability.

• Systemic accountability requires the alignment of forces - not just the school but the other two key arms of the system: academic wing and the 'senior management'. The academic machinery - teacher training institute and academic resource centers - can be effective only if the management demonstrates its commitment and priority to ensure that the academic arm is strengthened and measured for results on the quality of learning in the school. On the ground a simple example of such commitment would be that a Cluster Resource Person (CRP) is not used as an administration person but exclusively used to provide academic support to the school teachers in the cluster. A Block Education Officer who puts his weight behind this is an example of proactive management. The CRP's performance should then be measured only on how well he delivers support to the school.

A national focus on such an alignment is the way ahead.

S Giridhar
Head, Advocacy and Research

Different perspectives on all-round development

J Shankar

"Everyone follows a philosophy, whether he is aware of it or not."- *Aristotle.*

"Every human being has a philosophy of his own, good or bad, high or low, purely individual or common with others. Men live in accordance with their philosophy of life, their concern of the world. This is true of the most thoughtless."- *Aldous Huxley*

The linkage between happiness and economic gain is so well entrenched today that even the most idealistic among the youth will not disagree with the refrain: *more the wealth more the happiness*. The notion that an all-round life is a composite result of satisfying both the material and non material needs is fast fading.

Herbert Spencer, in his essay *What knowledge is of most worth?* says:

"It behoves us to set before ourselves, and ever to keep clearly in view, complete living as the end to be achieved; so that in bringing up our children we may choose subjects and methods of instruction, with deliberate reference to this end.

One first step must obviously be to classify, in the order of their importance, the leading kinds of activity which constitute human life. They may be naturally arranged into:

1. Those activities which directly minister to self-preservation;

2. Those activities which, by securing the necessaries of life, indirectly minister to self-preservation;

3. Those activities which have for their end the rearing and discipline of offspring;

4. Those activities which are involved in the maintenance activities which fill up the leisure part of life, devoted to the gratification of the tastes and feelings."

Guest column

While the schools these days stress the need for a healthy body and economic means, the other two aspects, focused on by Spencer, of bringing up children and cultivating tastes and feeling to use the leisure part of life, are largely being ignored.

How different our society would be if these two aspects were an integral part of our schooling?

We now proudly exhibit a 9 to 9 work culture, and the icon of success is a seven-day work week. It is worth recalling here what the Communist Party of the erstwhile Soviet Union had to say on *All round and harmonious development of the individual.* "In the period of transition to communism, there are greater opportunities of *educating a new man, who will harmoniously combine spiritual wealth, moral purity and a perfect physique".*

"All-round development of the individual has been made possible by historic social gains – freedom from exploitation, unemployment and poverty, from discrimination on account of sex, origin, nationality or race. Every member of society is provided with equal opportunity for education and creative labor. Relations of dependence and inequality between people in public affairs and in family life will disappear. The personal dignity of each citizen is protected by society. Each is guaranteed an equal and free choice of occupation and profession with due regard to the interests of society. As less and less time is spent on material production, the individual is afforded even greater opportunities to develop his abilities, gifts, and talent in the fields of production, science, engineering, literature and the arts. People will increasingly devote their leisure to public pursuit, cultural intercourse, intellectual and physical development, scientific, technical and artistic endeavor. Physical training and sports will become part and parcel of every day life".

Today, there is a dire need for us to cut down time spent on satisfying material needs and devote more time for developing abilities, gifts and talent.

Is there a lesson here? Can we gain something from looking back?

Extracts taken from *Anthology of writing by the world's greatest thinkers on Education, Edited by Wade Baskin*

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Education for Life

Amarjeet Sinha

Mere schooling does not hold the answer to mass education as individual excellence of a few cannot be the objective of a schooling system that has to cater to millions of the hopeful. The challenge of schooling in India is to be able to integrate this thrust of knowledge into a practice of skills.

The daily struggle of an adolescent in urban India, running from tuition to tuition and class to class, brings out the miserable plight of those wanting a place in the sun. Coaxing parents, a grave and sombre household, a ban on the television and the internet, facade of seriousness and loss of joviality, and most of all, an imposition on the private life of a growing adolescent, characterise what the quest for excellence has done to our growing adults, especially in the aspiring middle class homes. The poor are anyway discouraged by costs of private tutoring and choose to drop out at the earliest. The race for a position, an institution of choice, forces adolescents to adopt the ways of the grown-up very early in life. Telling lies to please parents, cheating to reach parental aspiration for grades, looking serious and unkempt to keep the facade of hard work, crass selfishness and individual pursuits to keep ahead of the peer group, all start happening rather early in life. This results in a crisis of values, a crisis of hope and most of all, a collapse of the social being who felt happy doing things for others.

His Excellency, the President of India, Dr. A P J Abdul Kalam, rightly remarked that smile and creativity both start vanishing with each year of the educational struggle. At the end of it all, most are declared failures at some level or the other, having to live with a very low self-esteem for the rest of their lives. In any way, of the 30 million joining Class I, barely three million continue in the 12th Grade. Of them, an even smaller number completes a useful college education. Surely this is not the route to an education for life, an education that builds on creativity, an education that values learning by doing, an education that focuses on experiential learning. Education for life is more than just numeracy and literacy. It is about coping better with life, it is about leading happier lives that are spiritually, physically, mentally, and to an extent, materially, more satisfying. Mere schooling does not hold the answer to mass education as individual excellence of a few cannot be the objective of a schooling system that has to cater to millions of the hopeful. We cannot kill the hopes of the millions to sustain the aspiration of a few thousand. We need to seriously look at what we are doing to the lives of our children and whether we are actually preparing them for life.

The tendency to compartmentalise education into primary, upper primary, secondary and higher secondary does damage to free-thinking on the issue of innovation, experimental and experiential learning, local geographies and histories, and most of all, on understanding the importance of a continuum that is consistent. No amount of stand alone curricular approaches, assessment systems and pedagogic innovation at the primary and upper primary level is going to sustain if the secondary and higher secondary boards continue to inflict their own brand of testing and syllabus. The transformation has to be systemic, covering twelve years of education if parents have to accept innovation in the learning process of children. That children are not coping with the curriculum load and the burden of non-comprehension is well known; the tragedy is that we are not looking at the issue of relevance and quality as the major reform issue covering the entire span of school education.

The debates on skills and vocational education have often been in exclusivist domains, as if only some children are capable of using their heads, and that for most children, it is the use of hands that will increase their productivity, human potential and employment opportunities. Such misplaced notions of streaming have posed serious problems in every country, especially when the vocational course is seen as the inferior option. The challenge of skills and vocation is the challenge of the mainstream system, relevant for each and every child. Gandhian experiments clearly demonstrated that 'samavaya' (integration of physical and mental development) is not only appropriate for relevance of education, but also as the most suitable pedagogy for learning. The challenge of schooling in India is to be able to integrate this thrust of knowledge into a practice of skills. If knowledge is to come by exploration, mastery over nature, experimentation and by doing, it must inform all levels of education. Integration of such approaches allows larger number of children in class to get noticed as performers as those who are good at rote learning may be total disasters when it comes to learning by doing. It is like sports and cultural activities as integral part of the curriculum – there suddenly emerge many more heroes, over and above the grade getters.

Globalization throws its own opportunities and challenges. The opportunities in the economic sphere start getting compromised when educational systems do not prepare children for coping with change and disappointments. Job changes, ups and downs in life, opportunities and threats, come along with globalization and the challenge lies in preparing children appropriately for it. Globalization is also a phase when learning has to become a continuing pursuit as acquisition of knowledge no longer remains a one-time affair. The threat of globalization lies in a very selfish value system that tends to reduce individuals into islands of self-aggrandizement, a world-view where material pursuits determine everything, a view where death of idealism happens every moment. Education for life has to provide our adolescents the wherewithal to face up to these crises. A strong value system is a need of the hour. Yoga, sports, meditation, promoting self-esteem through better communication skills, group activities, team tasks, cultural pursuits, are all effective ways of countering the threats of globalization and modernity.

Education for life is about individuals in society living together in harmony. It is about children growing up together, learning about their environments, mastering knowledge and skills in small friendly groups, by exploration and doing. It is about a facilitating teacher and a flexible curriculum, about a scientific temper that tests traditional wisdom and does not accept modernity uncritically. It is a world-view that Gandhi, Rabindra Nath Tagore, Dr. Zakir Husain and Sri Aurobindo wanted to develop through their experiments in education. Education for life is beyond narrow debates on textbooks or resources. It is about a fundamental restructuring of what we want to achieve among our adolescents and adults - to - be.

India has been very successful in allowing individual excellence to grow. It has produced some world class managers and IT experts. As a mass education, however, we do not achieve as much as we ought to as we do not sufficiently address the issue of relevance and education for life. White collar pursuits inform our educational content and this tends to alienate those who are unable to cope with the stress and strain of a 'heavy' curriculum. The need is to ensure that every child engages with the formal education system in a manner that he/she constructs knowledge and develops skills on the basis of experience and analysis rather than the wisdom of the textbook alone. There may even be a case for differential levels of curriculum with flexibility to students to take up what they can cope with rather than struggle through something that they are unable to develop mastery over.

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Measuring Learning

Sridhar Rajagopalan

Vyjayanthi Sankar

Mili Chandraker

Learning is intrinsic and subjective; it is not neat, linear or simple even to understand, let alone measure. Yet, efforts to systematically understand it better do yield positive results.

The fact that it is *difficult* to accurately measure the learning of an individual along multiple dimensions should not deter the efforts to measure it. Without these, teachers, and even school systems would not know *reliably* whether they are doing well or whether their students are learning the skills they need and the ability to use them in situations they will face in life.

Assessment *for* Learning

Well-designed tests aimed at accurately measuring learning are useful at many levels – that of the learner, the educator, the curriculum designer, and indeed society as a whole. It must be realized that the goal of *assessing student learning* is only one of the possible goals of assessment. In the larger context, good assessment can give valuable and detailed feedback, which can be a big aid in the learning process. That is what is meant by the phrase, "Assessment *for* Learning."

In this article, two aspects related to this fascinating topic will be discussed:
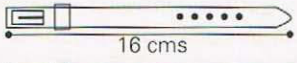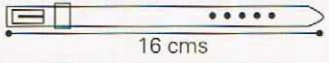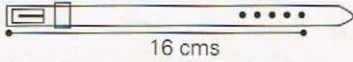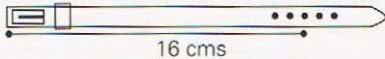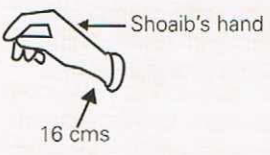
- Insights obtained about student learning from an analysis of their performance in large scale tests
- The use of statistical tools and methods to develop better test items and tests as a whole

Insights about Student Learning

Compared to a regular school test, multiple choice questions when administered to a large number of students[1], allow not only the percentage of correct answers to be uniquely determined; they also allow the patterns in wrong answers to be studied. The wrong options (called 'distractors') are carefully designed to catch commonly expected misconceptions, often on the basis of a pre-test conducted before the main test.
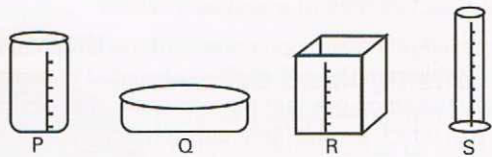
1. Children clearly have difficulty relating what is learnt in the class to even simple, practical applications in day to day life, like directions, estimations, etc. For e.g. when children were shown a picture of a man facing the rising sun with the compass directions and asked which direction would the man's left hand point to, surprisingly only 21.2% got this correct. An important takeaway from this illustration is that teachers should include as many practical examples and questions as possible related to a topic while teaching it – not only would this make the topic 'come alive', it would help children develop their application skills.

2. Children demonstrate weakness in interpreting pictorial or graphical information or where readings have to be taken. This is ironical and an issue of concern as a lot of information in today's world is represented visually.

[1] The examples here are drawn from ASSET, which stands for Assessment of Scholastic Skills through Educational Testing. ASSET is a voluntary test conducted by Educational Initiatives (EI), in English medium schools in India, Nepal and the Gulf for students of classes 3 to 12 in English, Math and Science. Large scale testing in regional languages has also been conducted by EI in municipal and rural schools in some states, and some data from those tests are also used here.

Class	Question and options	Correct Answer	Responses Obtained
5	Shoaib wants to buy a watch strap. If the length around his wrist is 16 cms as shown, which strap would be BEST suited for him?	D	A – 23.5%
			B – 32.5%
			C – 23.1%
			D – 19.9%

3. Many times the main idea or concept is not understood by children – learning is superficial, maybe only up to an exam that tests recall!

Class	Question and options	Correct Answer	Responses Obtained
7	Which of the vessels shown here will record the maximum rainfall if all are used at the same place and at the same time? Assume that none of them overflow. A. Both P and Q B. Both R and S C. Only Q D. All will record the same rainfall	D	A - 23.6% B - 38.7% C - 17.7% D - 18.1%

The concept involved here is that rainfall is measured in units of length, and any vessel of a *uniform cross-section* can be used to measure it. Even many teachers are unclear about the concepts in such cases.
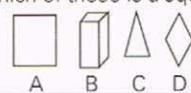
4. An area of concern seems to be that children get stumped at the first sign of the 'unfamiliar'. (Probably the idea that a test can and will only have items exactly from the textbook or class work has got engrained in the minds of parents or children. Anything else is 'out of syllabus'!)

5. A number of insights about specific errors in language, including grammatical and spelling mistakes, are derived from an analysis of the results. As in other subjects, questions where the 'most common answer is wrong' suggest a common misunderstanding and deserve special attention. For example when asked to choose the correct spelling from preferred / prefered / preffered / prefferred only 30.3% answered correctly with about 43.9% choosing the second option, 20.9% answered choosing the third option and 3.9% choosing the last option.

The overall learnings across the subjects seem to be that children are learning mechanically, often not understanding what they are learning; ability to apply learnings in real-life situation tends to be low; certain skills like estimation, measurement and visual interpretation – arguably skills becoming more important in the workplace – are weak spots; and finally, while comfort and recall with the familiar is high, students seem to get baffled with the unfamiliar.

Table 1 shows the performance of children from four different schooling systems on some common questions. The data should be treated as indicative and not representative because of many reasons, including the small size of some samples and some being non-random.

Table 1: Performance of Children from Different School Systems on the Same Item

Class	Question		% of children who answered correctly (number of children in bracket)			
		Correct Answer	Rural govt schools	Urban, English medium schools	Private, urban, regional medium schools	Urban municipal schools
4	Which of these is a square?	D	22.2% (557)	37.2% (4098)	16.7% (12)	20% (20)
4	What fraction of the children shown are boys?	2/5	36% (557)	56% (184)	50% (12)	0% (20)

Though such comparisons can provide insights, they should be the starting point for further research, not the basis to reach a conclusion. In this case, the number of students tested in some of the above samples is too low to reach any definitive conclusion.

Quantitative Tools in Test Design

Developing appropriate questions requires a lot of practice and a deep understanding of how children learn and think. Beyond this, however, some statistical measures can be very effectively used to determine the effectiveness of individual items on a test, as well as the effectiveness of a test as a whole.

For example, one can use statistical analysis to judge the appropriateness of the length of the test paper based on the number of questions not attempted by children. Indices can be calculated to analyse the performance of individual test items on a test paper (usually based on pre-test performance, or by adding special items in a test paper that are only used for analysis). Two of which are the 'item difficulty' and 'item discrimination' indices.

The process of analysing test results and student performance is a continuous and ongoing one. It is also important to realise that analysis of test performance should be only one parameter to understand how much learning is taking place, but done properly and systematically, it can be an extremely useful method.

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News Update

Child Friendly School Initiative

A holistic intervention for all round development of a child through:
- Head teachers – school management and leadership – both administrative and academic.
- Teachers – subject matter expertise, motivation and higher orientation to child centric practices.
- Parent body engaged in school – demanding accountability, relevance of education and playing an effective role in school management.
- Education officers – being an effective academic resource as change agents of school and classroom culture.
- Focus on issues related to sanitation, health and gender issues.
- **Our reach: 580 schools.**

Study in progress in a school at Chittoor

In Andhra Pradesh

A baseline study was conducted in 196 schools spread across seven mandals of Chittoor district of Andhra Pradesh during December 2004 to ascertain:

- The perception of all the stakeholders
- The extent of availability of various facilities.

Data on attitudes, perceptions and practices was collected from a total of 5,623 stakeholders which included head teachers (194), teachers (246), students (2,243), parents (2,395), school education committee members (524) and mandal resource persons (21). Childwise socio-economic data was also collected from a sub-set of the schools.

In Karnataka

Baseline study to assess the status of learning achievement has been completed in 303 schools in Shorapur block, Yadgir district. 200 evaluators in 50 teams of four each completed the study in six weeks. The data is being analysed and a comprehensive feedback will be provided to each school.

This feedback will also be used while preparing the school improvement plan in consultation with the education functionaries, community and the teachers.

Technology Initiatives

Contribute to quality enhancement through:
- Digital content development that addresses the issue of playful, interactive, child centric learning and assessment.
- Teacher training using technology to trigger actions related to child centric learning in the classroom.
- Education MIS system building to enhance management abilities and building capacity in the Government system.
- Solutions for developing abilities of mass training to build capacity among teachers, community members and education functionaries.
- **Our reach: 5339 schools**

Innovative Deployment

Think of a single PC with three display terminals, three keyboards and three 'mouses' which can all be used simultaneously as if there are three independent computers. This innovative idea from Azim Premji Foundation is deployed in the Computer Aided Learning Centre (CALC) at the Byatarayanapura Higher Primary School in Bangalore South district for the last two months and has been introduced in the CALC at Kurekoppa School, Toranagallu, Bellary district in Karnataka.

The innovation has substantially reduced the costs of installation. As there is only one CPU the maintenance cost will also be less. The total cost of ownership, which includes power consumption, UPS capacity and battery back up, is also significantly lower.
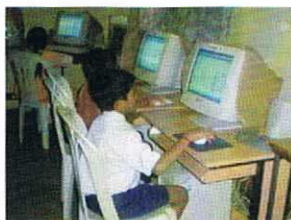
Deployed in CALCs is another innovation of Azim Premji Foundation – single speaker and multiple head phones that addresses the issue of noise levels emanating from different speakers.

Five new CDs

Five new titles, Friendly Animals and Journey on the Cloud in English, Swatantra Divas, Fun with Chinchoo in Mathematics and Khel-Mel in Hindi were released in February 2005. A total of 70 master titles are available. The state wise distribution of the CDs are: 68 titles for Karnataka, 42 for Andhra Pradesh, 35 for Tamil Nadu and Pondicherry, 18 for Urdu medium schools, 6 for Orissa , 14 in Gujarati, 3 for Punjab and one for Kerala.

Computer Based Assessment (CBA) in Andhra Pradesh

About 50,000 children took part in the Computer Based Assessment (CBA) meant for children participating in the Computer Aided Learning (CAL) programme in four districts. The CBA was held at centre/school, mandal and district levels in West Godavari, East Godavari, Kurnool and Visakapatnam districts and 19 children finally made it to the state level contest held at Hyderabad on February 28, 2005. One student each from class 1 to 6 emerged winners in the finals.

Children taking online test

There were a total of 85 questions which had to be answered in eight minutes. At the state level finals many toppers attempted all the 85 questions in just six minutes. The venue overflowed with students, parents, teachers, officials and invitees and cameras flashed and videos whirred but nothing disturbed the finalists who were a bundle of concentration as they handled the mouse and clicked on the right answers. Azim Premji Foundation had developed the relevant software for this assessment.

The toppers and all the participants at the state level test were felicitated by Mr. Ramakrishna Rao, Director of School Education, Andhra Pradesh. Children were awarded certificates by Andhra Pradesh Government and Azim Premji Foundation presented them with educational / scientific toys. The teachers and e - seva centres were also rewarded with certificates.

The CBA was first conducted in 200 centres in West Godavari district during April 2004 in which 30,000 children participated. Encouraged by the response and interest shown by the teachers, children and the community, the CBA was extended to the four districts.

Officials from other districts who participated in the programme have shown keen interest in conducting CBA in all the 23 districts in the next academic year. The Government of Andhra Pradesh in association with Azim Premji Foundation is implementing Computer Aided Learning (CAL) programme in 3,818 schools in all the districts of Andhra Pradesh.

Prize winning children

Learning Guarantee Programme

- Promoting accountability in the educational system for equitable excellence through assessment driven reforms.
- **Our reach: 3384 schools**.

Awards ceremony and school feedback

Lighting the lamp at the awards ceremony

Basava Bhavana in Bellary was on December 11, 2004 filled to the brim with primary school teachers and children besides education functionaries to receive the Learning Guarantee Programme awards. They represented 82 government schools of North East Karnataka that were declared winners for 2003-04.

A total of 1,443 schools (two lakh children) from the seven districts voluntarily participated in the programme in 2004.

Distribution of bags to winning school children

A significantly improved school performance report (with childwise, classwise, subjectwise details) has been provided to each of the 1,443 schools through the cluster resource persons in the 42 blocks of North East Karnataka. 42 volunteers from the Foundation have fanned out to conduct a follow up in each of the 1,443 schools and ascertain how schools use the feedback.

An oral test in progress

Expansion in Karnataka

The Karnataka government has now introduced the Learning Guarantee Programme across 202 blocks in all districts and the evaluation of 6,464 schools has been completed . Serving and retired school teachers, Cluster resource persons and education coordinators, who were all trained by Master trainers from District Institutes of Education and Training, conducted the evaluation.

Launch in Madhya Pradesh

The Learning Guarantee Programme has been launched in Datia and Vidisha districts. A team of 12 academicians from Rajya Shiksha Kendra and three Azim Premji Foundation members developed competency based question papers. Competencies were listed down on the basis of the curriculum and different ways in which these competencies could be tested were investigated. Resources like TIMMS, ASSET and AAA question papers, Homi Bhabha Science Centre and Eklavya were referred to and innovative questions introduced. These were field tested and the findings from these tests shared with experts and the required changes incorporated. These test papers have been distributed among the schools to familiarize them with competency based assessment.

Prof. Jalaluddin with students

Capacity Building Experiment

An experiment for academic capacity building for teachers, Jan Shikshak and Block Resource Coordinators in two blocks of the Datia and Vidisha districts has been initiated. Eminent education expert, Prof. A.K. Jalaluddin, is working with the academic resource group of the two blocks to demonstrate that reforms in classroom processes will help boost the confidence and morale of the schools to meet the challenge.

Orientation workshop

Orientation workshops were organized for all the Jan Shikshak (Cluster Resource Persons) at Datia and Vidisha districts. The Jan Shikshak communicated the programme to 2,677 schools in these two districts. Each school was given communication material viz. mailer, poster and sample of question papers. The sign of enthusiasm in participation can be gauged from the fact that 1,481 schools in these two districts have come forward to participate in the programme.

Orientation Programme for Jan Shikshak

Policy Planning Unit (Karnataka)

The eight member team of the Policy Planning Unit in the last quarter completed seven projects and started working on 10 new projects. It now has a total of 23 projects on hand.

- Pramata – (Prakriya Manthana Adhikarigala Tarabeti – Process Re-engineering and Officers' Training). The Pramata project will be fuelled by a core team of 'Change Champions' (called Parivartaneya Pravartakaru) numbering around 120 across the four divisions of the state and they are being trained.

Research studies

- As part of the study of the Trimester system of examination introduced in schools of Karnataka research tools have been field tested and discussed with stakeholders and experts.
- External evaluation of the 'Free Text Books' and the 'Mahiti Sindhu' schemes has been initiated.
- Bala Bodhane, a teaching technique, and Mobile schools programmes are being studied.

Budgeting and Finance

- Programme budgeting for Secondary education (2004-05) has been completed for the state government.
- Information sharing / websites: As part of the mandate to make information for planning freely available the PPU has helped in creating websites for the Commissioner of Public Instruction and DSERT.
- Community and education: The PPU was involved in drafting the bye-laws for incorporating the School Development and Monitoring Committees (details in the previous issue of Learning Curve) as the 'Issue based' committees under the Panchayat Raj Act. With this provision, SDMC would now have greater legitimacy and authority.

Mathematics Education Research: What Is It and Why Is It Important?

K. Subramaniam

Many different players need to contribute to substantially enhance the general level of the learning of mathematics in our schools: policy makers, curriculum designers, textbook writers, teacher trainers, researchers and above all, teachers. It would probably be correct to say that among all these groups in the country, the smallest and least developed is the community of researchers in mathematics education.

Many people may not even know that there is a field of research called mathematics education research. From an international point of view, however, this is an active and growing field of research. Research in mathematics education is concerned with understanding the processes of learning and teaching in order to improve students' learning of mathematics. Thus research in this field has an eventual practical intent of improving students' learning. The citations for the two prestigious ICMI medals in mathematics contain references not only to the research done by the awardees but also to their contribution to the practice of mathematics education in their countries and internationally. However, mathematics education research is not all about practice. A sophisticated body of theoretical knowledge has grown around the attempts to understand the hurdles that students face in learning mathematics. Conceptualizing inherently complex phenomena like a child learning, or a classroom process is a formidable challenge, which must often be met by drawing on a variety of disciplines. Thus researchers in mathematics education need to not only have knowledge of the subject of mathematics, but also to be prepared to study other disciplines that may have a bearing on their work: psychology, history and philosophy of mathematics, and sometimes specialized disciplines such as discourse theory (a branch of the study of language) and semiotics (the study of how symbol systems give rise to meaning). The interdisciplinary nature of mathematics education research poses a challenge for institutions that are training young researchers. But fortunately this fact also makes the field exciting for many students and researchers with an appetite for knowledge and discovery.

One of the useful contributions of mathematics education research is the elaboration of systematic errors that a large number of students make. An example of an error that is familiar to teachers is the 'subtract the larger digit from the smaller' error in vertical column subtraction, which leads students to write the answer for 65 – 17 as 52. Other examples are the so-called linearity error in algebraic simplification: $\sqrt{(a^2 + b^2)} = a + b$ and the 'conjoining error': $5 + 2x = 7x$. Researchers have not only uncovered and classified a large number of common errors in a host of topics, but have also had moderate success in explaining the origin of these errors. Many subtraction errors are produced by buggy algorithms, which in turn are a result of students' (often creative) patching up of gaps in their knowledge. The linearity error is produced by over generalizing rules extracted by detecting perceptual surface patterns in algebraic transformations. The conjoining error is often due to students' felt need to produce a 'closed answer' which is a habit carried over from writing answers to arithmetic 'sums'.

It is interesting to observe that these findings have a parallel in the sister discipline of science education research, which has investigated a large number of 'misconceptions' or 'alternative conceptions'. These are often the result of the interaction between students' strong intuitive ideas and new information. For example, some students reconcile their idea of a flat earth as a place where we live with the information that the earth is round, by invoking the 'hollow earth' model: we live on a flat bed inside a hollow earth. Other students have a 'twin earth' model: they believe that there is a twin earth, different from the flat earth we live on, that is round and up there in the sky along with other planets. The general principle that old knowledge interacts with new knowledge also holds in the learning of mathematics, and explains many difficulties that students face. For example, the very fact that students develop a strong and robust understanding of whole number arithmetic is also responsible for the confusions and errors that they display while dealing with fractions or decimals. One strand of research in algebra learning is concerned with elaborating the complex relationship between the learning of arithmetic and algebra: the precise differences between ways of thinking and problem solving in arithmetic and algebra, the interference from arithmetical knowledge while learning algebra, and ways of smoothing the transition from arithmetic to algebra.

The research on students' errors also illustrates the manner in which research impacts the practice of teaching and learning. One specific consequence of such research is the design of better and more refined diagnostic tests. However, the more powerful impact is on teaching. Many people think that the implication of research for teaching must be spelt out in the form of prescriptions or proscriptions for classroom teaching, analogous to the way in which medical research leads to the discovery of new medicines that can be prescribed in the clinic. This instrumental view of knowledge is, in the context of educational research, a mistaken or at least a premature view, and is one of the reasons for the wide currency of educational fads and 'isms' and quick fix prescriptions. Knowledge about students' errors and underlying causes raises a teacher's insight into her children's minds and consequently her skill to a new level. The way in which knowledge impacts an individual's practice is complex and subtle and one of the important mechanisms by which knowledge obtained from research can effectively influence the practice of mathematics education is better teacher education, both pre-service and in - service.

Of the many strands of mathematics education research, a productive and exciting field of research inquires into the impact of information and communication technologies on the teaching and learning of core curricular areas in mathematics. This research grows in tandem with the development of powerful educational software such as dynamic geometry software (which allow students to interactively discover many properties of geometrical figures) or computer algebra systems (which are capable of symbolic algebra including equation solving and calculus including solving differential equations), sometimes involving the collaboration of educational researchers and software developers. The networking of electronic devices leads to the emergence of new social dynamics that can be leveraged to power learning. One current research project investigates the emergent social space when electronic handheld devices (for example, graphic calculators) are networked within a classroom (between student groups and the teacher) and connected to a common display through a computer and a data projector. This can lead to completely new and unexpected ways in which students and teachers can collaborate in effecting learning.

A good deal of research is also centered on the creation of specific innovations for teaching a particular topic or concept of mathematics. The research literature and the community of mathematics education researchers plays a critical role in filtering new innovations that are truly effective and act as a repository and a transmitter of good educational practices from around the world.

An internationalization of mathematics education research has taken place in the recent decades. International assessment studies such as the TIMMS (Trends in International Mathematics and Science Study) and PISA (Program for International Student Assessment) are both symptoms and catalysts of this growing trend. The cultures and concerns of different countries are different and this can often enrich reflection and practice within a country. This wave of international focus has coincided with a wave of interest in the actual process of classroom teaching leading to an exploration of teaching styles and classroom cultures in different countries. The classroom culture in Asian countries, for example, is significantly different from those in Western Europe. Even within Asian countries there are differences. All this has led several leading researchers characterising the current phase of mathematics education research as the phase of research on teaching. This has opened up the possibility of more fruitful collaboration between teachers and researchers in joint projects. Indeed, in many countries in the world, experienced teachers with a research bent have moved into a career of education research, enriching the field by bringing in their experience of several years of teaching.

Mathematics education research is still a nascent field in India. At the Homi Bhabha Centre for Science Education, we are trying to build a programme of research in mathematics education that preserves strong links with classroom teaching of mathematics and with in-service teacher education.

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The Social Context of Elementary Education in Rural India

Sujata Reddy

The social context, which refers to the various facets of the overall socio-economic environment in which a person / group lives, is extremely relevant to the subject of elementary education in India since it governs the access, retention and achievement levels of school going children.

This research is based on a review of the major published literature on the social context of elementary education to understand the role played by the economic, socio-cultural, religious and demographic factors in facilitating as well as impeding the educational opportunities of children in rural India.

The current scenario of primary education in India is that, though remarkable progress has been made in universalization of elementary education, as is evident from improved access, near total enrolments and higher literacy levels, the situation is still characterized by irregular attendance, dropouts and non-completion of primary education among children. Research findings reveal that the reasons for this situation lie, to a large extent, in the socio-economic conditions of rural India marked by caste, class and gender inequalities.

Economic factors play an important role in influencing schooling decisions of children. Studies reveal that factors such as high income levels, land ownership, non-agricultural occupations and economic motivation for son's education are positively correlated with high enrolment, attendance and continuation.

The report examines the debate regarding the manner in which poverty constrains educational attainment of rural children. Statistical and empirical evidence point to how poverty hinders schooling due to the high costs involved for families. These costs are of two types. The opportunity costs (which refer to the value of time lost when children forgo work and attend school) are high for the education of girls who bear the burden of domestic work. They are also high for boys who are withdrawn to supplement farm labour during peak agricultural activity. Recent research studies have countered the theory of opportunity costs with data on time utilization of children. This finds that small children spend a negligible amount of time on work, with opportunity costs becoming relevant only for older children, who are capable of more productive work. Moreover, it has been found that child labour is more often than not a 'default activity' taken up after they have dropped out rather than being the cause of their discontinuation. Macro surveys and studies have also found the direct costs of schooling to be too high for poor families. Various incentive programmes of the government to meet direct costs have very often not successfully reached those for whom they were intended. The mid-day meal scheme has, however,

been successful in increasing enrolments in many states.

The major socio-cultural factors influencing school participation of certain groups have been identified as gender, caste, tribe and religion. In rural India, girls' participation in schooling has been lagging behind that of boys due to several socio-cultural factors such as gender division of labour, son preference, puberty and early marriage, kinship practice of patrilocal village exogamy, hypergamy and dowry, and economic disincentives for girls' education etc. However, in recent years, there has been an improvement in the school attendance of girls with facilitating factors playing a contributory role such as male literacy of the community, parental literacy - especially mother's literacy, equitable gender relations and higher status of women, and the matrilineal kinship principle.

The socio-cultural factor of caste hierarchy has historically deprived the backward and scheduled castes from exploiting educational opportunities. Lower castes have suffered educational deprivation due to low income, child work, parental illiteracy, physical segregation and social discrimination in the community and at school. At the same time caste has also acted as a facilitator through the formation of caste associations which have used education as a vehicle of social mobility.

Tribes have been traditionally excluded from schooling

due to cultural and linguistic discontinuity, poverty, illiteracy, distant location of the school etc. However, certain factors have facilitated tribal literacy in some areas such as role of Christian missionaries, gender equality and an egalitarian social system among tribals as well as tribal dominance in particular states. Religious beliefs have impacted schooling of certain religious groups negatively in the case of Muslims and positively with reference to Christians where education has been transformed into a social value.

Finally, the socio-demographic factors that have hindered educational attainment have been identified as the poor health and low nutritional status of the mother and child, adverse sex ratio, family size, birth order of children, age at menarche and seasonal migration.

A few methodological implications have emanated from this review of literature. Causes of educational deprivation are multiple and single focus explanations for the same are inadequate. Social reality has to be viewed holistically. Moreover, factors often work in tandem and varying combinations, such that the negative impact of some may be counter weighed by the positive impact of others.

It is relevant to recognize the importance of the social context in which our education system functions.

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Observation Study of School Practices: Learning Guarantee Programme-2004

Rishikesh B S

The second year of evaluation under the Learning Guarantee Programme held in July, August and September 2004 covered 2.18 lakh children of 1,443 schools in the seven districts of North East Karnataka. A number of research studies are being undertaken by Azim Premji Foundation on this Programme. This is the summary of one such study.

Introduction

This study identified certain practices that may have contributed to a school's success in the Learning Guarantee Programme (LGP) which is in its second year in the seven North East Karnataka districts. This was done by observing general practices that are followed in schools that won the LGP award and those that did not; and schools which did not participate.

Objectives

The main objective was to study certain student / teacher behaviour aspects and classroom practices. Is there any difference between schools that participated in the LGP and those that did not? The study also

aimed at finding out if any outside factors like community, education functionaries influenced the school performance or the in-school process.

Sample

A total of 21 schools from eight blocks in seven districts were randomly selected for the observation study. Of these 10 were Lower Primary Schools and 11 were Higher Primary Schools. These schools belonged to three categories: Learning Guarantee Programme winners (10 schools), Learning Guarantee Programme non-winners (four schools), and non-participants in the programme (seven schools).

Points of observation

A two member team spent three days in each school and captured certain issues related to the administration, teaching learning processes, students' behaviour and general awareness, and community participation in school related activities. The teachers and classroom practices observed were of the lower primary classes. The team was given the necessary orientation

and training to undertake the observation study. Specifically the team observed:

1. Punctuality of the head teachers, teachers and whether the schools opened on time or not.
2. Educational and recreational opportunities provided by the schools.
3. Classroom practices such as the teaching learning processes.
4. Work plan and student management.
5. Student awareness – their general awareness and community and social service inclination.

The study of classroom/school observation aimed to look at certain behavioral aspects of the teachers, teaching methodology and the overall classroom environment that included organization and management of lessons, classes and students. Accountability mechanisms and infrastructural availability were other aspects studied.

FINDINGS

Head teacher / Teacher

Teachers in all schools, except one school in each category, behaved cordially with the head teachers and carried out the roles assigned to them. In one school each in the non-winning and non-participating category and in three schools in the winning category the head teachers did not involve themselves in the mid-day meals programme. Hence a majority of the head teachers across the three categories played a significant role in the mid-day meal scheme. The head teachers in a large number of schools across the three categories were punctual and maintained the records; but in three out of four non-winning schools the head teachers were not supervising the activities of the teachers such as examining the lesson plans or classroom practices, which is a crucial difference between the head teachers in the winning schools and the non-winning schools.

Punctuality and time spent in school

In all the 10 LGP winning schools the head teachers always arrived on time. In three out of four schools among the non-winning and four out of seven among the non-participating schools the head teacher was punctual. While the head teachers in half of the LGP winning schools stayed back after school hours this trend was found in none of the four non-winning schools and in only two of the seven non-participating schools. Thus, there is a clear difference in punctuality and the time spent at school by the head teachers in the three categories.

There is a similar pattern among the teachers. In nine LGP winning schools all teachers arrived on time; none of the non-winning schools had all their teachers arriving on time; and in only one non-participating school all teachers arrived on time.

In five out of seven non-participating schools, the teachers stopped teaching ahead of schedule, sometimes as much as by two hours. This trend was also observed in two of the four non-winning schools and one winning school. Thus teachers did not adhere to school timings in a majority of the non-participating schools; and in half of the non-winning schools; and in only one winning school.

Pedagogic practices

Teachers made a work plan and executed it in half of both winning and non-winning schools, but teachers only in two out of seven non-participating schools did so. All the teachers in eight out of 10 LGP winning schools encouraged their students to ask questions and this was observed in two schools each among the four non-winning and seven non-participating schools. Classroom sessions were interactive in all the LGP winning schools and in three out of four non-winning schools but only in three out of seven non-participating schools. Eight out of 10 winning schools and three out of four non-winning schools conducted special classes either before or after the school hours or both the times. This trend was evident in only one out of the seven non-participating schools.

Among the winning school category teachers in all the schools behaved in a friendly manner with the students, conducted interactive sessions, assigned homework and gave individual attention to the students.

Out of the ten schools in the winning category eight schools conducted special classes, six created activity based learning solutions, and four used TLMs.

In three out of four non-winning schools teachers were friendly with the students, conducted interactive sessions, assigned homework and conducted special classes; but only one of these schools followed activity based teaching methods or paid individual attention to the students; and none used learning materials. The trend was similar in two out of seven schools in the non-participating category, except that none of the schools held special classes. Hence a clear difference emerged in the number of schools displaying desirable 'pedagogical' practices among the three categories with the winning category having the highest number.

Punishment

'Scolding' was the only punishment in six out of 10 winning schools. But only one out of four non-winning and two out of seven non-participating adhered to the rule of 'no caning'. Despite more number of winning schools sparing the rod the overall discipline among students was good in the winning schools. In eight of the 10 winning schools students were not found fighting among themselves. This trend was observed in only one non-winning and three non-participating schools.

Student awareness

To collect data on the general awareness and civic consciousness of students both group discussions and depth interviews were conducted in each school. Findings were interesting: for example, most of the students across the three categories of schools knew that aeroplane was one of the fastest modes of transport available; importance of hygienic surroundings.

Students in all the four non-winning schools said they would stand in queue for buying even in a shop owned by a close relative or help an aged person even if it meant reaching late to school and getting punished thus displaying their social responsibilities. This trend was not found in half the number of 10 winning schools. The non-participating schools fared badly here and only in one of the seven schools did all the students choose the desirable answer regarding civic and social issues.

Role of SDMC, Parents and rest of the Community

In all LGP winning schools, the SDMC was active and the school staff considered it to be a positive influence on the schools' development; but this was true in only half the number of schools among the non-winning schools; none of the non-participating schools considered the SDMC as active and useful.

The parents evinced interest in the academic progress of their students in all the LGP winning schools and the staff had a very positive opinion about them, whereas staff of only half the schools among the non-winning and only one out of the seven schools in the non- participating category made positive comments about the role of the parents.

Community members (other than the parents and SDMC) in all the winning schools were generally aware of what was happening in the school, including the performance of teachers. However, in the non-participating category not even a single community to which the seven schools belonged showed any interest in their school. In fact there was an instance of a community member walking out when 'school' was raised as a topic of discussion. And among the four non-winning category schools only in one village people showed some interest in the school.

Functional libraries and co-curricular activities

A functional library existed in only five of the 21 schools. Of these, four belonged to the winning category and one to the non-participating category. None of the non-winning schools had a functional library. And with regard to co-curricular activities seven out of the 10 winning schools had scheduled activities for their students; however, only one out of the four non-winning school had co-curricular activities and none among the non-participatory schools had any.

School assemblies were held in eight out of ten winning schools; in two out of four in the non-winning; and four out of seven schools in non-participating categories. In one school each among the non-winning and non-participating categories the assembly was only a formality, just to obey the rule. In less than half of the total number of schools in non-winning and non-participating categories assemblies were held in true spirit. In fact two schools in the non-participating category ignored the practice altogether. This showed that the winning schools gave importance to co-curricular activities.

Department officials

Except for one school in each category, teachers across the three categories reported that they received help from the Education Department officials in solving their academic and non academic issues. This may have contributed to the success of a school but it is not the sole factor because a majority of schools in the non-winning and non-participating category also viewed the involvement of the officials as positive.

Infrastructure

The availability of infrastructure seemed to have had no bearing on the performance of the schools. Infrastructure like compound, sufficient number of class rooms and functional toilets, were found in only two schools in winning and one in non-winning category. Among the non-participating schools three schools had equally good infrastructure.

The 'pupil-teacher' ratio in all the 21 schools varied from 10:1 to 57:1. Interestingly, the 'lowest' and also the 'highest' pupil-teacher ratio was in the winning school category. In the non-winning school category the pupil-teacher ratio ranged from 21:1 to 54:1 and in the non-participating schools the ratio ranged from 26:1 to 49:1.

The conclusion

The findings broadly indicated that a school's good performance could be linked to three broad aspects:

- A head teacher in command of the situation and leading by example
- Professionally behaved teachers who are punctual and create interactive learning environment
- An active and 'understanding' SDMC.

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Parivartaneya Pravartakaru – the Journey of Change has begun

Gurumurthy Kasinathan

- *Change! Is it not a difficult and painful process? Why should we change?*

- *Even if we want to, will we be able to change? We have worked for years, even decades, in given ways and how can we suddenly operate differently?*

- *And if we change, how will we face our colleagues in our department – they would be functioning in the ways that we have always done, and how will we respond to their doubts?*

These were some of the questions we faced in the first 'Orientation' meeting of the group of 'Change Champions' at Dharwad (in Belgaum division of North Karnataka).

The creation of a core group of 'Change Champions' across the four divisions[1] of the state of Karnataka is the first step of a two year programme called Pramata. Pramata is an acronym standing for Prakriya Manthana, Adhikarigala Tarabeti ('Process Re-engineering and Officers' Training) in Kannada. The Pramata programme is being coordinated by the Policy Planning Unit (PPU), a collaboration of the Education department of the government of Karnataka and Azim Premji Foundation.

Pramata aims to significantly enhance the system and capacities of the education department towards higher levels of accountability to stakeholders, through these two components. The first component - Process Re-engineering or process revision - aims at simplifying the work and information processes and systems in the education department thus making it more effective. It is modeled on the 'Business Process Re-engineering' concept used in the corporate sector, but with significant changes to adapt it to the government sector. Hence this component, which we may call 'Government Process Re-engineering' (GPR) works at the macro level to address systemic issues in the department.

The second component - officers' training - aims at building and strengthening the capacities of the officers in the department in several areas, such as Management, Finance, Human Resources and Information Technology. Management would include the management processes of planning, organizing and monitoring; management of time, knowledge, risks; as well as people management aspects such as organizational dynamics, motivation, team work, etc. Thus, this works at the micro or individual level. The core group, comprising of around 30 officers in each of the four divisions, has the responsibility of acquiring mastery in the components of process re-engineering and capacity building and rolling the same across to the 4500 odd officers in the department,

thus fully earning the *nom de guerre* of 'Parivartaneya Pravartakaru' ('Change Champions' in Kannada), by being the first to change, and by leading the charge for such change.

The Policy Planning Unit organized 'orientation' meetings in Mysore, Raichur, Dharwad and Bangalore, for the four divisions, to discuss and further evolve the nature and scope of these two components with the change champions.

Well, change is difficult … and more so in the beginning. As Newton's Law of Inertia states, "Every body remains in its state of rest, or uniform motion in a straight line, unless acted upon by an external force". It takes far more effort to initiate change but lesser effort to keep up the momentum of change.

So when, during the orientation meeting at Dharwad, in my session on 'Change', I asked all core team members to stand up on their chairs, there was reluctance to do so. I stood on my chair and waved vigorously to the team, then a few stood up, then some more... and still some more, but only one member sat glued to her chair.

We then resumed our session on 'Change'. This was an interesting conversation, conducted at rarified atmospheric levels!

Standing on the chair, looking at, and discussing with others who were also standing on their chairs, the world looked a different place. We discussed the nature of our initial inhibitions and fears which discouraged us from standing up.

One member explained, "I was hesitant to stand on the chair, since I did not know what was to follow. Hence the fear of the unknown is a major cause for resisting change".

Another responded, "When I saw others stand on their bench, my own fear of change reduced, and this process of desensitization caused by time and experience (watching others stand) encouraged me to follow".

A school teacher spoke of the oddity of our positions, "In a class, a student is punished sometimes by being made to stand on a bench, while here we all are standing voluntarily and do not look at this as a punishment, but rather as an exercise of solidarity".

This pointed to the role of perspective in change management. Change can bring pain that can be significant even if temporary, and gain, which may appear small initially and consolidate over time. "We are members of one family and our fear has disappeared", said another, underlining the need for peer support in sustaining change and thus the

[1]Bangalore, Belgaum, Gulbarga and Mysore are the four divisions in Karnataka

importance of networks such as the change champions to support and sustain change.

The lone team member who was still sitting in the chair wanted us to resume our seats! She was uncomfortable being the only person sitting! This demonstrated another principle. After the initial momentum has been built up, and people have joined the process of change, then it is those people who have stayed behind, who feel the heat of their own inertia! So an attempt to change may not by itself have to get every member to change; rather once an initial core group has changed, it creates pressure on peers to follow; and most of the others will eventually do so. 'Are you feeling uncomfortable sitting?' was the tongue-in-cheek question posed to her. In fact, nobody was in a mood to resume their seats; after all, we were seeing the world differently!
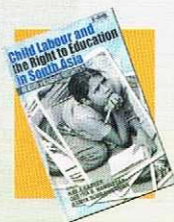
Thus, the first law of motion gets rewritten: 'Every body remains in the state of rest or uniform motion in a straight line, unless acted upon by an internal force, such internal force arising from the desire for change, desire for fulfillment of one's potential and one's dreams.'

One member echoed Gandhi, 'We must be the change that we wish to see in the world.'

Mao had said, 'The journey of a thousand miles begins ...but with a single step'. And the meeting of the Parivartaneya Pravartakaru in Mysore, Raichur, Dharwad and Bangalore marked the first step of the Pramata journey.

Gurumurthy Kasinathan is Team Leader, Policy Planning Unit at Azim Premji Foundation.

//Book Case

Child Labour and the Right to Education in South Asia: Needs versus Rights
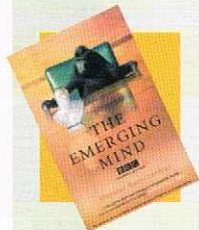**Naila Kabeer, Geetha B Nambissan, Ramya Subrahmanian**
Sage India – 2003

The twin issues of child labour and children's rights to education have become a matter of international concern while gaining prominence in national developmental efforts. This book brings together a range of perspectives concerning the causes of and solutions to the problem of child labour in South Asia.

Shiksha Aur Samajh
Rohit Dhankar
Aadhar Prakashan, Panchkula – 2004

The essays contained in this book emerged during the course of the author's decade – long engagement with running the experimental schools of his organization, Digantar. These essays written at different points of time reflect his concern with the educational discourse taking place in the country.

The Emerging Mind, BBC The Reith Lectures
Vilayanur Ramachandaran
MacGuru - 2004

An interesting and engaging presentation of how the study of patients with neurological disorders has implications far reaching for humanities, philosophy, aesthetics and even art.

Language Disadvantage: The Learning Challenge in Primary Education
Dhir Jhingran
APH Publishing Corporation - 2005

This study analyses the learning disadvantages faced by children whose medium of instruction is different from the dialect they speak at home. Some successful strategies in this area, have been outlined by the author.

Clarification

- In November 2004 issue of Learning Curve we published an article on Role of SDMCs (page 15). It was mentioned in it that the Policy Planning Unit (PPU) studied the role of SDMCs. The study was conducted by the PPU in collaboration with Centre for Child and Law (CCL), National Law School of India University. By oversight this point was left out in the article.
- In the article 'Teacher Absence in India' by Karthik Muralidharan & Michael Kremer (November 2004 issue, page 8) the column headings in Table 2 got interchanged inadvertently. The columns should correctly read as

The errors are regretted.

State	Teacher Absence (%)	Present Not Teaching (%)	Present Teaching (%)