Vinod Raina

BETWEEN BEHAVIOURISM AND CONSTRUCTIVISM

Quality education in a multicultural context

With over 400 spoken languages, a tribal (indigenous people) population of nearly 100 million, Hindu, Sikh, Christian, Jain and Muslim religions practiced by large sections of populations along with a myriad of other ethnic and cultural identities, flourishing local knowledge systems, social differences based on caste and class so palatable; defining a National system of education of good quality has remained a formidable and elusive challenge in India.

Should the content reflect the cultural and social location of the child? Do local knowledge systems related to agriculture, health and medicine, artisanship and folk cultural forms have any place in the formal education system? If so, how should they be balanced with the more 'universal' forms of knowledge? What about language? Should it be mother tongue, Hindi and/or English — how many should be taught to a 10-year old child? Most of these questions apply to other post-colonial multicultural locations as well, around the World.

Translated to pedagogy, the intense debate is whether the colonial pedagogies, deeply entrenched in indoctrinal forms of behaviourism ought to persist, or need they be replaced? While it is contented by many that a constructivist approach can accommodate the specific cultural roots of the child and aid in assimilating the child's knowledge into a larger knowledge system, critics have also warned of the risk of cultural relativism.

For 30 years, between 1972 to 2002, many of these questions and challenges formed the basis of a very large experiment in improving the quality of school education in India, the Hoshangabad Science Education Programme (HSTP), which formed the basis of the latest National Curriculum Framework (NCF) formulated in 2005. The paper will use the empirical work of the HSTP and NCF2005 to address some of the questions raised earlier to indicate possible directions processes of quality education ought to take in multicultural contexts.

Keywords Hoshangabad Science Education Programme (HSTP); National Curriculum Framework (NCF); education; multicultural contexts

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Most of these questions apply to other post-colonial multicultural locations as well, around the World. The challenge to carve out a post-colonial mind that can engage an increasingly homogenizing World order being crafted by processes of globalization is perhaps the foremost educational challenge of the present times.

Translated to pedagogy, the intense debate is whether the colonial pedagogies, deeply entrenched in indoctrinal forms of behaviourism ought to persist, or need they be replaced? The argument being that behaviourism negates the cultural and social location of the child, as also its historical knowledge system, there by suppressing its identity; so as to 'civilize' the child by 'removing' from it elements of 'inherited backwardness'. It is contented by many that a constructivist approach, particularly approximating the ideas of Vygotsky, can accommodate the specific cultural roots of the child, particularly linguistic, and aid in assimilating the child's knowledge into a larger knowledge system, rather than replace and substitute it completely. Critics are however quick to point out the dangers of cultural relativism in this approach, and the denial of universal critical knowledge, as embodied particularly in the sciences and mathematics. The danger of cultural relativism becomes enhanced in contexts where religious fundamentalism, as in India, attempts to posit religion-based education as the ultimate system, and demands its uncritical acceptance.

For 30 years, between 1972 to 2002, many of these questions and challenges formed the basis of a very large experiment in improving the quality of school education in India, the Hoshangabad Science Education Programme (HSTP), involving around 1500 rural government schools, of which the author was a participant for the entire duration. Though the experiment was closed in 2002, its principles form the basis of the latest National Curriculum Framework (NCF) that the Indian Government formulated in 2005. The paper will use the empirical work of the HSTP and NCF2005 to address some

of the questions raised earlier to indicate possible directions processes of quality education ought to take in multicultural contexts.

The Hoshangabad Science Teaching Programme (HSTP)

The HSTP, more popularly known as Hoshangabad Vigyan, began as a partnership between two voluntary agencies, Friend's Rural Centre and Kishore Bharati and the Government of Madhya Pradesh in 16 rural middle schools of Hoshangabad district in 1972. Adding a new partner, the National Council of Educational Research and Training (NCERT), through its Regional College of Education based at Bhopal, the programme was extended to cover all the middle schools of the district – around 220 at that time – in 1978. In 1982 a new non-governmental organization (NGO), called Eklavya, came up with the concurrence of the Planning Commission, Department of Science and Technology, Government of India, University Grants Commission (UGC) and the Government of Madhya Pradesh to replace the original two non-governmental groups, and extend the partnership with the Government of Madhya Pradesh to other districts of the state, and in to other subjects and classes of the elementary school. In 2002, 30 years after its inception, the collaboration between the Government of Madhya Pradesh and Eklavya had extended the science programme to over 1500 government schools in 14 districts of Madhya Pradesh, created an experimental social science programme in middle schools, and a primary level programme, Prashika, in many other schools. It was then that the Government of Madhya Pradesh decided to call off the collaboration, asking all its schools where these programmes were running to revert back to the state books and examinations.

Though there has been unabated curiosity about the final, somewhat whimsical, decision of the Madhya Pradesh government in 2002 to close down the programmes, particularly given the 30 year history of collaboration, this paper will obliquely delve into that, since this is not intended as an in depth study of the 30 years of Hoshangabad Vigyan – that will require a fairly thick book. I hold the opinion that the order to call off the collaboration was not an academic decision based on the merits or demerits of the pedagogic practice of Hoshangabad Vigyan; it was based on issues other than academic. The theory and practice of Hoshangabad Vigyan has in fact much to offer in the present times, given a heightened awareness about the need to improve the quality of mass education in the country. Though arguable, one may yet claim that underlying the conviction of the NCF2005 to prescribe for a change in the paradigm of school pedagogy is the knowledge that many of the suggested prescriptions have actually been practiced and tested in Hoshangabad Vigyan

and similar other field programmes; and the framers of NCF2005 were keenly aware of that.

The problem

Compared to earlier times, like 1972 when Hoshangabad Vigyan was initiated, the heightened awareness and concern for mass school education in both governmental and non-governmental sectors in India today is a positive and welcome change. However, given the contested nature of issues surrounding education at any point of time, it is not surprising that heightened awareness and concern has also brought about a sharper debate amongst a plurality of views regarding the problems, priorities and solutions, sometimes quite acrimonious. With the increasing penetration of market-based ideologies during this period, situating education within the larger socio-political frameworks has become an intensely contested area, as regards the responsibility of the state and the role of the market. The repercussions are far reaching. Not only has the precise nature of the problem become hazy, even seemingly straightforward terms like 'quality', 'access', 'right', 'data' and even 'school' have assumed varying meanings.

Education of equitable quality

There are four major problems of school education in India: access, retention, quality and equity. Whereas non-enrolment is mainly a consequence of lack of access that can be tackled by providing a school, the enormous rates of non-retention and lack of achievement are far more complex, difficult to understand and handle, and are clearly linked to the deficiencies in the quality of the delivery system. Some of these deficiencies are well-known and relate to inadequate infrastructure, like lack of toilets, particularly for girls, lack of drinking water, run down school buildings unusable during monsoons, absence of teaching-learning materials and so on.

Other factors are social and human and relate largely to the social atmosphere of the school, in particular, to teacher absenteeism, behaviour and motivation. An atmosphere of fear and authority in the school and classrooms, aided by physical punishments and humiliating behaviour with children from low-castes, tribal, minority and other weaker sections of society by socially prejudiced teachers coming from high castes, ensures the pushing out of a very large number of children from schools. Since most of the children from weaker sections happen to be first generation learners whose parents are illiterate, they lack the kind of family support that helps overcome the travails of the school, as children from middle-class families often have. Treated as a burden in the

school and without an atmosphere conducive to school learning at home, dropping off would be the logical choice for most of these children. Social and cultural discrimination is therefore a major factor in the drop out phenomenon of Indian schools.

Combined with the earlier factors, the lack of *interest* and *irrelevance* of the school's content and process to a majority of children completes the process whose outcome is non-retention and lack of achievement. These twin factors, interest and relevance, should have been at the heart of the Quality debate in school education, but mostly are not.

The reason they are not has to do with the perspective to the content and process of education, as also to the nature of institutions that undertake to implement such a perspective. At the perspective level, what is ignored is that in a multicultural, multilinguistic, multi-ethnic and class, caste and gender divided country like India, interest and relevance – hence quality – have to be woven around each of these categories, in a manner that extends the frontiers of knowledge beyond the exigencies of birth and social location, enhances pride in one's own cultural identity while at the same time creating self-confidence to respect and negotiate other identities with empathy; and empower to break free of shackles imposed by caste, class and gender. While recognizing that there exist certain universal elements of knowledge and learning that must be at the centre of the content and process, *the challenge is to creatively adapt them to each of the earlier mentioned socio-cultural identities and divides.* Such adaptation provides us with the framework of 'Equitable Quality' as against a homogenized notion of Universal Quality of Education.

The institutional constraint should therefore be obvious. Curriculum framing, syllabus, and text book preparation is undertaken either at the national level, by the NCERT, or at the state level by the State Council of Educational Research and Training (SCERT) or their equivalent institutions. Social and cultural plurality exists not merely at the district level, but even within a district. These institutions are therefore not structured to address, and hence incapable of, creative adaptation for equitable quality in the manner outlined earlier. But for the recent exception coming out of the NCERT, namely the NCF2005, these institutions have mostly stuck to the familiar notion of quality – of bringing the frontier areas of *subject information* (not knowledge) increasingly into lower classes, and using the performance at the memory driven annual and board examinations as a dubious criterion for determining the intrinsic quality of a student or a school.

Since government schools (except perhaps Kendriya Vidyalayas) have not sparkled to provide 'good results' based on the earlier criteria, they are dubbed as being of low quality, and those private schools that literally coerce their students to perform better for these criterions are designated as being of 'good quality'. Accordingly, a view seems to have emerged during the post-market years in this country that nothing of quality is likely to come out of the public school system and the shift must be made to the 'better quality' private

schools. Not surprisingly, this view even considers the use of public money to expand private schooling, through the 'voucher system' as a desired policy initiative, and there is vigorously lobbying for that to happen during the forthcoming eleventh five year plan period.

The basic question could therefore be sharply posed as: Is the notion of quality that designates the private school system as being better, valid; and is it correct to assume that the governmentally funded public school system is more or less doomed, and nothing of quality can be expected to emerge from it?

Revisiting Hoshangabad Vigyan could provide useful insights, if not a substantial answer to this question.

Origins of the programme[1]

Friend's Rural Centre (FRC) at Rasulia in Hoshangabad town is a very old Quaker initiated enterprise, and was even visited by Mahatma Gandhi at some point in time. One of the foremost educationists of the country, Marjorie Sykes, was associated with it. FRC helped to set up another group Kishore Bharati (KB), 90 kilometres away in a remote rural area of Bankhedi block of Hoshangabad district in 1971. KB's mandate was to work with rural youth rather than school children, hence the name. During the course of their work, staff members of FRC would travel all over the district and notice that not much was being transacted in the government schools that they would come across. This made them wonder whether a meaningful intervention could be made to improve the quality of these schools. It so happened that people associated with KB were aware of a school science improvement programme that was being run in Bombay municipal schools at that time, through the Tata Institute for Fundamental Research (TIFR) linked Homi Bhabha Science Centre. Connections were established, leading to a joint proposal by the FRC and KB to the Government of Madhya Pradesh in early 1972 to allow them to initiate a science education programme in a few middle schools of the district on a pilot basis. Surprisingly, permission was granted,[2] which made the two groups put most of their other activities on hold and scurry to contact people across the country to come and help to set up a resource pool. Apart from scientists from TIFR and other people associated with the Bombay programme, a large group of scientists, researchers and students came forward from Delhi University, and a few from the Indian Institute of Technology (IIT), Kanpur. The Delhi University volunteers were later kind of formalized into a Delhi University Group, through the initiative of the UGC, which formally allowed them to be associated with the programme. After a few years when the programme was extended to the entire district in 1978, a conscious effort resulted in many college and university teachers from Madhya Pradesh becoming associated with the programme. And much later, scientists from the Centre for Cellular and

Molecular Biology (CCMB), National Institute of Immunology (NIO) and similar organizations also got involved with the programme.

The original permission allowed the pilot to be run in 16 rural middle schools, nine in the Rasulia block and seven in the Bankhedi block of the district. The classes to be covered were six, seven and eight, with the added condition that the teaching learning materials and methods could be changed, but not the syllabus. The classes coincided with the ones that were being experimented in, in the Bombay municipal schools, which therefore provided the basis for the initial academic inputs to the programme.

The teaching-learning methodology

The important thing to note is that the programme, rather than emanating from a state or national policy or scheme, was initiated on the basis of local perceptions and needs, by local groups. But in order to implement it, they had to convince and bring in national level resource volunteers to the field. The origins of the teaching-learning approach were however not just national, but international, and had to do with the Cold War conditions of those times.

The launching of Sputnik by the Soviet Union in 1957 rattled and stung the Western powers. It not only signified that the Soviets had won the space race, but worse, suggested that the science and technology infrastructure of the then USSR was better than that of the United States and its European allies. This was captured in a phrase of those times – 'Ivan knows better than John'. Amongst the many reviews ordered in the United States, Britain and other countries to find out what was wrong, a startling answer came up, that the school science methods of these powerful countries were outdated and required immediate overhaul; that the mass scientific manpower was deficient right at the base, the school level. This revelation spurred attempts to rectify the situation through new innovations, two of which became well known in the early 1960s: the Harvard School Science Project in the United States and the Nuffield Science Project in the UK.

News and details about these efforts travelled worldwide, as also to India. The All India Science Teacher's Association tried to implement aspects of this new approach in Doon school. But it was in the Bombay municipal schools project that the Harvard and Nuffield approaches were substantially tried out, before the ideas travelled to Hoshangabad in 1972 for a much more elaborate and extended adaptation to local conditions and culture.

Essentially, the pedagogy was based on 'learning by doing'. The notion that science education is a mere accumulation and memorization of facts of science, as was the practice earlier, was sought to be replaced by a pedagogy that laid emphasis on the process of science that leads to discovery and critical thinking. At the heart of the practice was to replace textbooks full of

information with workbooks that facilitated actual experimentation by children, and helped them to deduce inferences. In a way, the pedagogy could be summed up as 'Learn as a Scientist does'. Where as such an approach seemed valid from the point of view of practice of laboratory science, it had support from other areas too, particularly from Piaget's work on children's developmental psychology. Based on his findings regarding learning stages of a child, the thrust of Piaget's work was to suggest that there are some universal principles regarding how children learn, and they closely follow the process by which a scientist learns, and hence, the child is like a scientist, giving rise to the popular notion of a 'Pupil as a Scientist' framework. Not surprisingly therefore, the workbooks prepared under Hoshangabad Vigyan were titled 'Bal Vaigyanik', which translates as 'Child Scientist'.

This was the basic framework. The innovative challenge was to adapt it to the realities of the makeshift and impoverished government rural middle schools of Hoshangabad district. In places where having a blackboard and chalk in a classroom was a big achievement, creating an experimental science package demanding science kits seemed revolutionary. Costs had to be kept at the bare minimum, and the non-availability of items needed for experimentation in such remote areas was a constant reminder. And then there were the teachers. Never ever exposed to such approaches, how would they handle teaching when there was no book containing all the information?

The conditions were perhaps worse than what exist today in government schools, now that the DPEP (District Primary Education Program) and SSA (Sarva Shiksha Abhiyan [Education for All]) money has trickled into large parts of the country. The teachers were less qualified; some of the 42 from the original 16 schools, though teaching science in middle schools, were no more than 'middle pass' themselves! But most of them, unlike teachers of today in many states, were pre-trained in Basic Training Institutes that existed in Madhya Pradesh then.

It was soon realized that the book prepared for the poor but urban Bombay municipal schools, but was not relevant to the rural realities of Hoshangabad. Rural deprivation was however converted into an asset. After all science is the study of nature – it is still referred to as 'natural science'. And nowhere does nature abound in somewhat untouched form as in rural India. The soil, rivers, agriculture, animals, insects, flora and fauna, a sky much less clouded by smog present a ready made laboratory for crafting chapters on botany, zoology, geography, the solar system, food, water, anatomy and so on. The impoverished class room therefore need not be a hindrance if the chapters are based on nature that exists outside the classroom. That is precisely what was done – the natural rural environment became a free laboratory for activities, surveys and observations to generate first rate scientific knowledge that none of the expensive private schools can ever hope to do when confined to their expensive classrooms. Some activities on stars and solar phenomenon had to be done at night, and many schools whose teachers lived in the same

village happily conducted those activities, altering the notion of a fixed time school. These were not extra-curricular activities, but part of the workbook and could feature in the innovative examinations that shall be described later.

But not all science can be reduced to field activities and observations. Study of light magnetism, electricity, chemical reactions and so on requires lenses, magnets, cells, bulbs, chemicals, some glassware, a heat source and so on which had to be provided. Children would do their experiments in groups of four, and for a class of 40, the total one time expense for such equipment was around Rs 1200, with about two rupees per child per year as recurring cost for consumables and breakage. This was provided by the state government to the concerned schools, along with new purchase and administrative rules.

The major innovation was to combine curriculum development with teacher orientations. An intense in-service residential training programme of 21 days per year was made an integral part of the programme from the very beginning. Between 1972 and 1975, resource persons would come with hand-scribbled first drafts and stay on for a full month to consolidate the scribbles into formal chapters using the teacher understanding, feedback and suggestions as a guide. Since nearly all the chapters were activity-based, these activities would be conducted repeatedly at these trainings to ensure that they would work at the school level. Teachers therefore played a major part in devising the chapters, performing all the activities with their own hands at the trainings, and understanding how to weave the results of the activities into generating knowledge which had to be recorded by the children. In this way, the workbook and the children's record book together constituted the text book, as we know.

The first drafts of the classes six, seven and eight teaching-learning materials were created in this manner by 1975. But since these were still tentative, they were not printed in book form but as separate cards that were kept in the school for children to use. As and when a new or better method was devised in a particular school by children or a teacher, it was incorporated by reprinting the concerned card. Thus curriculum development was integrated with teacher training and classroom practice as a continuous process in these formative years.

Monitoring and evaluation

Members of the resource team were involved in intense monitoring during the pilot phase of the programme, 1972–1978. Some people from Delhi University took six months off from their teaching, made possible by the involvement of the UGC, and spent them in Hoshangabad, cycling from school to school every day to monitor the classroom practice. A system of monthly meetings was devised whereby teachers from each block assembled on a

designated day with the resource persons to take stock of the academic aspects of the programme, share new innovations and discuss classroom problems.

This process was continued when the expansion to the district took place in 1978. Only now a larger monitoring pool became necessary. In consultation with the education department, the school-complex idea of the Kothari Commission was invoked whereby volunteer higher secondary school science teachers were given training to monitor the middle school science in schools close to theirs. These were not informal, local or makeshift arrangements, but policy decisions that were duly notified by the concerned offices of the education department. The day of absence of the higher secondary school teacher from his/her school when on a monitoring mission was considered as duty leave.

The major challenge was that of examinations and evaluation. Given that the methodology was based on generating knowledge rather than memorizing it, it was clear that the mainstream examination was irrelevant. Since children were mostly engaged in experiments and activity, it was also clear that ability to perform experiments must also be a part of the evaluation system. The problem was how to devise the written examination methodology. Since the year-round training was on deduction and inference, an examination methodology that stressed on understanding and comprehension was therefore devised beginning with the first annual school examination of class six students in 1973. Since the stress was on comprehension rather than memorization, it was not felt necessary to bar children from consulting their workbooks or record books during the examination. The questions therefore were so designed as to test application of knowledge in a new situation, infer from given data or information, or a description of an activity that the children had performed.

The first major confrontation between the programme partners was witnessed as the time approached for the class eight board examinations in 1975. Since the middle board existed at the district level, the education department insisted that a common question paper in science would be administered to all the children of the district, irrespective of their method of learning. But faced with the reality that a common question paper would be irrelevant to children who had learnt through an activity method, it is to the credit of the education department that they finally notified that a separate common paper be created for the Hoshangabad science children, using different rules and processes, which included that it would be an open-book examination. This was perhaps one of the most progressive academic decisions of a state government anywhere in the country. These decisions in the formative years of the programme set the blueprint that was largely followed at each step of expansion.

There was a particular innovation in the evaluation mechanism, which though too technical to be described here in detail, still requires a mention. Centralized board examinations are full of problems and ideally need to be

given up. There is no way of knowing if all the thousands or lakhs of children being examined studied a particular chapter all over or not. The level of complexity of a question could also depend on the way it was taught by different teachers in different schools. Thus people who frame questions can go wrong, which however gets revealed only when the answer sheets come in! And what is the expectation from a centralized examination: to discriminate between the good, the average and below average students; to get a spread. But if most of the children do equally well in a question, or most of them do equally badly, such a question fails to provide such a spread. The only way to correct these anomalies of the Board examination is to first check a manageable but statistically valid random sample of the answer sheets, assess the quality of questions and then decide which question should have less weightage and which should have more. This is done by statistically calculating two indices, the discriminant index and the facility index, based on the sample answer sheets, and then use these indices to rework the weightage of each question. Having done that, all the answer sheets, including those used for random sampling are now marked.

This system was introduced in the class eight Board examination of Hoshangabad Vigyan and continued to be used in its expansion stages. This implies that the local teachers and education department personnel were not only exposed to the intricacies of improving the quality of open-book centralized examinations, but got trained to undertake this task year after year.

The resulting empowerment of teachers is evident from the following incident that took place just after the Board examinations of, I think, 1984. There was a sudden flurry of activity in the education department when it was known that a starred question was coming up in the State Assembly that might have grave repercussions on the programme and some of its teachers. A Member of the Legislative Assembly (MLA) had referred to a question in the last Board examination on the chapter on chance and probability. This chapter, based on very interesting activities using coins and dice and invoking the 'toss' of the cricket matches to compute probabilities for 'heads' and 'tails', as also in other simple situations, was very popular with teachers and children. A group of teachers had prepared a question that asked children to use their knowledge of probabilities to compute the chances of winning at a two and three digit *satta* (a widespread form of gambling), and to conclude whether playing *satta* was mostly a losing or a winning proposition. Most of the children had correctly concluded in the examination papers that based on the laws of probability, playing *satta* was mostly a losing proposition.

The starred question in the Assembly contented that by referring to *satta* in the question paper, Hoshangabad Vigyan was inducing children to gamble and hence encouraging immoral practices. For that reason the programme ought to be closed down and the teachers who set the question severely reprimanded and punished. The question received a jumbled and somewhat hilarious answer from the Education Minister, at the end of which the Speaker intervened to say

that even though the Minister had responded, given the sensitive nature of the matter, an explanation ought to be sought from the concerned teachers who had set the question. In a spirited reply the four teachers contented that *satta* was eating into the entrails of the society and science provided a convincing answer that if you indulge in it, you will lose over time. This they regarded was a better way to wean people away from *satta* than through customary moral sermons. Also, since they had been repeatedly trained and told to try and link the school to the social life outside, by making children work out the losing nature of *satta* they had done precisely that, concerning a burning issue. If that deserved punishment, they were ready to be punished. The matter was immediately dropped! In a 19 page rejoinder in the Assembly another MLA traced the history of chance and probability and outlined its importance in quantum mechanics, molecular biology and other subjects, concluding that if members of the house raised the kind of questions that the previous member had, history might call the Madhya Pradesh Assembly an Assembly of *vidushaks* (jokers).

Does one require any more convincing of what is achievable in terms of quality of education and self-confidence in poor and impoverished government school conditions, and through their much maligned teachers? Or must good quality remain mythically linked to the marks obtained in rote learning based Board examinations?

Administration and expansion

It should be apparent by now that Hoshangabad Vigyan was not trying to intervene in one particular aspect of quality improvement, say preparing new textbooks, or just training teachers, or improving management, which is a mode more familiar nowadays. Quality improvement in education can never be achieved by fragmented and piecemeal approaches, since each aspect is dependent on the other. The dilemma of the present NCERT is a case in point. Having prepared the NCF2005 document, it is now engaged in making textbooks based on the Framework. And some of these books are refreshingly better than the previous ones. These books will be used in the Central Board of Secondary Education (CBSE) schools, but NCERT does not have the capacity to train all the teachers in these schools in the use of these new books. And the examination is controlled by the CBSE. Perforce, the attempt will remain fragmented, confined to creating new books. In particular, examination is the magnet that aligns all the educational processes. If they remain unchanged, the full potential of the new books will remain untapped. There is a larger problem with such fragmented approaches. Much as the authors and teams of the new NCERT books might wish, it is virtually impossible to put activities in these books with a certainty that they will actually be conducted in the school.

That is because administrative and management functions, that take decisions regarding funding equipment and kits in the kind of schools that use NCERT books lie somewhere else.

This is similar to the situation that Hoshangabad Vigyan faced, particularly when it was expanded beyond its pilot phase. The first expansion in 1978 covered all the middle schools of the Hoshangabad district. There was serious debate whether the up scaling would not result in loss of quality. Management and administrative systems, somewhat muted in the pilot phase, became a new challenge. Where would all the funds for the kit come from, how would they be administered, should the kit be supplied centrally or in a decentralized manner? If decentralized, where would the schools procure them from, since even district retail of science kits does not exist in this country. Logistics were daunting. To ensure that the kit materials reached all the remote schools, many of them without proper roads and cut off during monsoons was a nightmare. Then came the question of storage. Most of the schools were run down, insecure and without any storage space or almirahs. Who would be responsible if the kit was pilfered, or many of its items, particularly made of plastic, were nibbled away by enormous field rats that abound in the agricultural villages! And what rules should govern the use of some of the materials during festivals and marriages! Most of the schools also act as marriage halls and festival venues in the village where, in particular, the traditional feast is held. The mugs, plates and buckets in the science kit come in very handy on such occasions!

With the expansion in the number of teachers to be trained, the resource group too needed expansion. For that a campaign had to be launched to attract academic volunteers from the colleges and universities of the state, to supplement those coming in from other parts of the country. The existing rules did not allow such involvement of higher education faculty in school education. The cards would no longer do and books had to be printed, that too in a new format that required double colour printing, one for instructions and the other for questions. But the existing state rules did not allow that. The design of the books required them to be child friendly and very different from the existing ones, and resource persons from institutions like the Industrial Design Centre, IIT Bombay and the National Institute of Design were willing to volunteer, but existing rules did not allow 'outsiders' to be involved in such tasks.

One could go on and on. For each of these tasks, and many more, a new rule was made or the existing ones were suitably modified. One says all this to underline that such administrative tasks are not secondary to writing textbooks and training teachers on the path to quality improvement. And many academicians have little stomach to engage in this transformation. I believe one of the major achievements of Hoshangabad Vigyan, as big if not bigger than writing new materials and books, teacher trainings and examinations, was to finally compile all the new and modified rules of implementation – administrative, financial and personnel into an Administrative Manual that was formally notified by the state government through its gazette.

This critically ensured that the fragmented elements were integrated into a unified practice. That should however not be misconstrued to mean as if all the problems were solved. Time delays, running after files and officers, kit not reaching many schools and many such problems persisted, but the existence of a formal administrative mechanism helped overcome managerial adhocism.

This also facilitated further expansion of the programme, beyond the district. By 1981, a few resource persons showed willingness to give up their jobs in order to work full-time to consolidate and expand the science programme further, and start similar innovative work in other subjects and in the primary stream, classes one to five. For a variety of reasons, it was felt that the energies of the new persons could be better utilized by creating a structure different from FRC and KB. That new structure, which was formally established in 1982, was named Eklavya, signifying the battle of a downtrodden adivasi to learn by doing. One of the immediate tasks that Eklavya undertook was to spread its centres in other parts of Madhya Pradesh and engage with the state government in the expansion of the science programme to other districts. By 1986, the programme had been seeded in school complexes of 13 other districts, made largely possible because of the existing administrative procedures for the programme. Eklavya also initiated pilot programmes in social sciences and primary education with the government, which were all finally closed by the government in 2002.

New challenges

Hoshangabad Vigyan provides a comprehensive and integrated approach to curriculum, teacher trainings, examinations, monitoring, administration and management for government school quality improvement, through a decentralized district model. With appropriate modifications it could be adapted at any level of the elementary and even secondary school, for all the subjects, anywhere in the country; as Kerala already has. The costs are not enormous. With the presence of a DIET (District Institute for Education and Training) in nearly each district of the country, a very important component of the state education system has been made available, that did not exist for most of the time Hoshangabad Vigyan was in operation, and which has been made the nodal unit in the Kerala adaptation.

It was 35 years back that the programme was initiated. During this long period, a lot has changed, in particular in the area of science education and in the nature of *science-society* relations. The 'Pupil as a Scientist' framework has come under a serious review, as has the Piagetian notion of the individual learner going through age determined stages of learning. Piaget's own colleagues and students, (for example Margaret Donaldson in her book *Children's Minds*) have extended his findings to reveal that the cultural

environment of the child is not neutral to the stages of learning, which may therefore not be so universal after all. It has also been fairly well established that children's learning does not really take place alone, individually, in the sense of a research scientist, but it goes through processes of 'scaffolding', which is helped by peer interactions, and friendly adults, including the teacher. And language is central to such scaffolding. There must be a lot of 'chatter' all the time, as when children play amongst themselves. From these considerations, which in no way are uncontested, the language and approach of Bal Vaigyanik books, which is very 'precise' and perhaps even 'curt' might need a review. Within the constructivist paradigm, it is increasingly being recognized that more than Piaget's ideas of cognitive development, the social constructivism of Vygotsky that lays stress on the linguistic and cultural location of the child might be more significant, which demands a serious engagement regarding the role of language in learning science; and nowhere would that be more important than in multilingual India.

The major change of course is in the relation between science and society. We are witness to the alarm bells that have been rung regarding the reluctance of children and students to take up science in schools and colleges, as revealed by enrolment data for the past decade in the country. So why are students turning away from science? No science education programme today can do 'business as usual' without reflecting on this. We are also witnessing a peculiar phenomenon world over, that *technological expansion is going together with retreat from reason.* Revivalist, creationist and faith based knowledge and institutions have a great deal of following and popularity today. Where do we locate the scientific method and critical thinking in such a sociology of knowledge? It is apparent therefore that a considerable amount of upgrading of the original pedagogical elements of Hoshangabad Vigyan would be necessary, if it were to be practiced today.

It is truly pathetic that such questions are not central to the quality of education debate in the country today, but school vouchers, exposure to computers, English language learning, marks obtained at the Board examinations, and the ultimate – campus placement in a job worth a lakh of rupees or more per month, handling stocks or finances in a bank or a corporate office, or selling consumer goods, are.

Notes

1 In the absence of any official or unofficial recorded history of the programme, except for stray references here and there, what follows is like oral history, based on my memory. I was associated with the programme from nearly its inception, as part of the Delhi University group, and later as the co-founder of Eklavya. Memories can vary; hence it is possible that others associated with the programme have perceptions different from those recorded here. An old

article of 1977 can be found at http://vidyaonline.org/arvindgupta/hstppix.pdf and an assorted set of documents at http://www.cisl.columbia.edu/grads/presi/EKLAVYA/

2 The process leading to the granting of permission is interesting and somewhat hilarious, but is being omitted here. One may however say that it became possible because of some committed bureaucrats, who had political backing to allow such collaboration. That was perhaps because the Nehruvian ethos of bringing in scientific temper through school education still prevailed in some quarters during those times.

References

Donaldson, M. (1978) *Children's Minds*, London, Fontana/Croom Helm.