

Preface

Introductory remarks

Documentation of the Hoshangabad Science Teaching Programme (HSTP), which ran predominantly in rural government middle schools of Madhya Pradesh, is almost non-existent even though it was one of the longest running interventions in the government system of education in India – running as it did from 1972 to 2002. Sushil Joshi’s “Jashn-e-taleem” was therefore a welcome addition to the meagre body of literature on HSTP when it was published in Hindi in 2008. Sushil Joshi’s work was a labour of love, considering that he has dedicated a considerable portion of his working life to HSTP – almost 20 years while it was still operational and subsequently to Eklavya’s publication and science programmes after its premature closure. His account is both comprehensive and encyclopaedic arising from a close association with the programme that not many were privy to. It is written with considerable sympathy and understanding and touches on almost all aspects of the programme from the early beginnings to its final closure. I HSTP has not closed. It continues to live on in the lives of the thousands of students, hundreds of schoolteachers and many resource persons whose good fortune it was to have participated in it. It also lives on in the educational programmes that have engaged Eklavya’s attention both while it was running and even after its formal closure.

It is with great pleasure and a sense of privilege that I take this opportunity to write this preface to the English translation of Sushil Joshi’s book titled “Never a Dull Moment” also published by Eklavya. I know of many who have read “Jashn-e-taleem” and benefitted from it but I also know of many, whose lack of facility with Hindi has not permitted them to engage with it fully. They will now be able to do so and the reach of this work will be considerably increased. I believe that students of education and those who worry about the future of science education in Indian schools equally need to be aware of what HSTP attempted and why, what it managed to achieve and what it did not. They need to be aware of the lessons that they can learn from the experiences of the programme. That is why this translation was sorely needed.

The AISTA experience

I will begin by giving an account of my own personal journey with science education and the way it is entangled with the early phase of HSTP because that is the period in which my involvement with it was closest. It all started with the attempt by the Physics Study Group of the All India Science Teachers Association (AISTA) to develop a series of experimental workbooks in Physics for middle schools in India. BG Pitre was the Director, Professors HS Hans and Yash Pal were Consultants and I, a young university lecturer who had just completed his PhD, was a member of its writing panel. The group comprised mainly teachers from public schools across North India and the philosophy and approach of the group were very strongly influenced by the Nuffield Science Programme. An interesting thing to note is that the study group was funded jointly by the National Council of Educational Research and Training (NCERT) and the National Science Foundation. A series of meetings and workshops were organised in public schools in Dehra Dun, Ajmer and Nabha and on 26 January 1971 the first part of the workbook “Physics through Experiments” was published. However the whole initiative

soon collapsed because the NCERT withdrew its funding at short notice although it had promised support for three years and even though the manuscripts of the workbooks for the subsequent two years were ready, only the workbook for year one could be published. The decision to stop funding probably also marked a change in NCERT policy when it switched from supporting external agencies (external to NCERT) for curriculum development to in-house development and production.

There were a number of reasons as to why the AISTA programme collapsed. The primary reason was of course that NCERT withdrew its financial support after the first year workbook was published. A contributing reason was also that the schools from which the teachers were drawn to the group were all elite public schools with well-equipped laboratories of their own and most were already using the books and materials from the Nuffield programme on which the AISTA material was based. It is most likely that the management of the participating schools viewed the local effort as inferior, not kosher enough, having been produced by their own teachers, in comparison to the Nuffield material, which certainly had much better production values to say nothing of the excellent quality of the basic material.

The other thing of note is that although BG Pitre and his colleague CK Dixit were certainly instrumental in taking the programme to the Bombay Municipal Schools, the transition was in no small measure facilitated by Yash Pal by virtue of his being a mentor of the AISTA group while being based then at the Tata Institute of Fundamental Research in Bombay.

The Bombay experiment, however, also proved to be short-lived and folded up when the participating schoolteachers realised that their students, although taught the new curriculum with the new methodology, would actually be expected to sit the conventional Board examination at the end of class VII, for which the programme did not prepare them in any way.

The Delhi Group

In August of 1972, Anil Sadgopal came to the Chemistry Department of the University of Delhi to give a talk on the Hoshangabad programme, which had then just begun. There was a sense of *déjà vu* as I listened to him in the audience. When he spoke of the philosophy and the physics material that the Hoshangabad programme was using, it all sounded so familiar and so strongly reminiscent of the AISTA effort I had been part of for the previous three years. It was therefore easy for me to become a part of the team of faculty members from the science departments of the university, gathered together in a short span of time to help provide academic support to the nascent programme.

The meeting in Delhi was followed by visits by teachers from Delhi to see the programme in action in the 16 schools around Rasulia and Bankhedi. I remember my first visit to attend a monthly meeting that was to be held in Kishore Bharati in September-October 1972. The overnight journey in the third class sleeper by the GT Express to Hoshangabad, the two-rupee trip in Kale Khan's tonga to Rasulia from the railway station, the trip on the Land Rover with Sudarshan Kapur to Kishore Bharati, crossing the dry river bed on the way, the school visits around Bankhedi, the abject

conditions of the schools, the interactions with the schoolteachers during the day continuing into demonstrations of zero-cost experiments at night in a dimly lit room with straw spread across the floor, sleeping out at night with the stars so bright it would appear you could reach out and pluck them from the sky, then returning to Delhi and the sharing of experiences in a lecture theatre in the Physics Department packed with students and teachers – these and other such experiences fed into the formation of the Delhi group. The group consisted of teachers and students who agreed to come together to take on the academic responsibility for developing the physical sciences part of the Hoshangabad curriculum. The group examined the workbook that had been put together for the first year (the Bal Vaigyanik with the red cover, which came to be fondly known as Lal Vaigyanik) and decided to write the material afresh while accepting the philosophy and the approach. It undertook the responsibility of getting the first-year material ready and trial it at the teacher training programme that was to be held the following summer. It also persuaded, first the authorities of the University of Delhi, and then the mandarins of the University Grants Commission (UGC) to allow members of the group to be given Duty Leave, two at a time, to spend up to six months in the field getting familiar with the conditions in the schools, to develop curricula, do regular school follow up and organise monthly meetings of the programme schoolteachers. As many as nine members of the Delhi group made use of this provision, which was written into the statute books by the UGC. This was a historic decision because it thereby legitimised, for the first time in India, the official engagement of university faculty with work in school education. Faculty members of Madhya Pradesh colleges and universities later used this provision to enable similar participation in HSTP.

The Participating Schoolteachers

One must remember that as a matter of policy, none of the schoolteachers who participated in HSTP were specially selected and, as it turned out, many had studied science only till the middle school. They were not specially qualified to participate in the programme. Considerable investment of time and effort had therefore to be made in convincing them of the philosophical groundings of the programme, getting them to discard the traditional pedagogy they used in the classroom, getting them familiar with the new way of teaching, the new material they would be using, the new experiments they would be getting their students to perform and the kinds of discussion they would have to guide their students through in order for them to arrive at the conclusions that they were expected to.

We became aware of the almost complete intellectual isolation of these schoolteachers who had almost no access to sources of information or support mechanisms that could help them with problems with their teaching or the difficulties that they would encounter in their classrooms. They had no access to libraries, no experts they could consult to help them answer any of the questions or settle any of the doubts that arose in their minds as they went around their daily duties of teaching children. Trying to remove this isolation was one of the most important challenges the programme faced and we tried to respond to this by organising prolonged contact with them of subject experts during the annual training programmes, during monthly meetings and school follow up visits. We tried to empower our schoolteachers by involving them as much as possible with all aspects of the programme – with curricular development, improvement of curricular material, the

framing of question papers, by mentoring them as much as possible and by treating them with respect and listening to their views and opinions.

The role of schoolteachers in HSTP was not envisaged as one that one traditionally comes across in Indian schools, of being the source of all knowledge in the classroom; but neither was there any attempt to make his or her role redundant. It was in recognition of a teacher's central role in the pedagogy of the programme that so much effort and resources were expended on the intensive teacher training programmes that were a mandatory part of the project.

However, it was also true that our interactions with them sometimes had little effect on the commitment of individual teachers. Some of them clearly couldn't care less. They felt they were made to work hard, harder than their colleagues who were not part of the programme, without any reward. Yet teachers attended our meetings and training programmes in large numbers and often with a great deal of enthusiasm and interest. It goes without saying that despite our attempts we certainly failed to carry every teacher with us and the number of such teachers increased as the programme grew and it became more difficult to maintain the same level of intensity of the interaction of the resource group with them. There is no gainsaying the fact that in most instances the motivation and commitment of teachers to their profession is a personal one but it is not as if external factors do not matter. We knew of teachers who were casual in their work in their school, but when they happened to get transferred to a school where the parents were vigilant about the quality of the education their children were receiving, the behaviour of the same teacher changed for the better almost overnight. However, such cases were rare.

This brings us to the question of community involvement in the management of education. Its after-day critics sometimes blame HSTP for not attempting to engage with or involve the local community in the running of its programme. There are some obvious benefits that can derive from such engagement but like many things it can be a double-edged weapon. Whether such involvement would be beneficial or not clearly depends on the nature of the involvement – the devil as usual lies in the details. It would most certainly have an impact on teacher accountability and work ethic. But this must be weighed against its possible adverse impact on teacher professionalism. If you extend the involvement of the community to the level of teacher appointments and decisions in matters related to the curriculum, as would become inevitable once the local *panchayat* bodies begin to taste power, the results could be disastrous. How would one ensure that involvement would remain at the grass roots level of the community and not be hijacked by the community 'leaders' in yet another exercise of power and control? How would minority interests be protected and who would guarantee the presence of secular and plural views when it came to curricular matters? These are not unfounded fears as not so long ago the value of π , the ratio of the circumference to the diameter of a circle, was deemed by fiat to be 3 in some areas of the United States because the local community demanded that it be in conformity with the value ostensibly implied in the Bible.

Experiments in the Curriculum

One of the challenges of science is that although it seeks to search for universal laws, it must begin with the study of local phenomena. Its quest for generality must be rooted in the particular. Unlike mathematics, which can be based only on logic and reasoning, science uses logic and reasoning and applies them to observations and experiments based on the real world and not an artificial world defined by some autonomous set of axioms and postulates. Science must base itself on observations and experiments because it must, in the ultimate analysis, make statements about the real world around us. It is the closeness of the correspondence of such predictions with the world of phenomenon that provides the touchstone for the acceptability of any scientific theory.

Thus it is imperative that experimentation and observation should be at the heart of any pedagogy of science, particularly at the school level. Although there was no self-conscious effort to actually teach the scientific method in HSTP, it is also true that we believed that we should not lose sight of this central truth that science is not the same as mathematics and that students have to be shown that science is firmly rooted in reality and not merely a construct of the human mind.

The situation in our schools in the 1970s even in the best of our schools used to be that there is hardly any experimentation in the science classrooms and it has not changed much in the intervening forty years. And even the little that did or does exist is not experimentation by the students but some odd demonstrations by teachers. The situation even today is that experiments are either totally absent or even when they are present, most of the experimentation is in the form of verifying already known laws – there is practically no investigative activity involved. Is it any wonder then that most of the students we graduate are good in theoretical studies but so lacking in basic scientific skills, including experimentation and analysis?

There is need therefore to critically look at why the Indian school system, whether government or private, does not encourage experimentation. There is the oft-touted explanation that it has to do with inherent Brahminic Indian sensibilities – the disdain for working with one's hands. Such arguments are quite fashionable amongst our intellectual circles but I wonder how much truth they carry. The more likely explanation is the disinclination to make investments in infrastructure on the part of those who are in charge of implementation of programmes, which also translates into a disinclination to make the associated investment in teacher training. To me, however, the main reason would appear to be a lack of appreciation of the role of experimentation in science learning among those that design science curricula and manage education resulting from their almost total lack of connect with the pedagogy of school science. It is rooted in their understanding, or rather their misunderstanding, of the epistemology and philosophy of science and the central role that experimentation and investigation play in the learning and making of science. They suffer under the delusion that science is a finished story, that at least at the level of school science, all the interesting questions that could have been asked have already been asked and answered and that the role of science education is merely to get students to, in essence, memorise the answers to other people's questions. They fail to perceive that science is not a closed story and that even children can and do raise questions that can be original and sometimes extremely difficult to answer.

Whittled down to its basics, the underlying principle of HSTP was simply to teach science for better understanding. In the Indian context where students had no exposure to observation, experimentation or investigation in science classes, it translated into teaching science through experiments to be performed by children themselves. The need to revise the middle school curriculum, prepare new work books and organise experiments that were low-cost and could be performed by students in rural schools, the need for teacher training and the necessity of collecting feedback from teachers and students, the need for regular school follow up, the need for a different system of assessment – all followed as consequences of this basic principle.

We realised that the curriculum could not be driven only by the discipline but also had to be responsive to the environment of the child and to the needs of good citizenship. It had to be sensitive to challenges the future could bring. And as, according to an old Danish proverb, it is difficult to make predictions, especially of the future, the best strategy is to teach children so that they can learn to learn for themselves, by possessing enquiring minds and as well as the ability to devise how to answer such questions through personal and collective investigations. This is the best education we can hope to give to our children.

Kit of Equipment

If you want to run an experiment based science teaching programme, you must ensure that the equipment for performing the experiments is available in the schools. Since the overwhelming majority of our schools had no laboratories, this meant that such equipment had to be provided by the organisers. Thus a suitable laboratory kit had to be devised and delivered to each participating school. The Hoshangabad programme was not the first to develop a kit of equipment to go with its curriculum. We were aware of the fate of the UNESCO kits that had been supplied to schools in the mid 1960s. These remained unutilised and we still saw them in some of the older, better known schools in Hoshangabad during school visits. Ships are safe in harbour but that is not where they are meant to be. The main reason for the non-utilisation of the kits was the fact that teachers were held responsible for all breakages and loss – so the kits remained locked in almirahs and boxes gathering dust – safe but unused.

Since the kits were critical to the programme we had to ensure that conditions in school were conducive to their utilisation. We made sure that teachers were fully conversant with its use. During the training programmes it was imperative that teachers were trained to perform every experiment that children were required to do in class. Regular replenishment of the material, allowing for breakage, usage and loss was ensured. We also encouraged children to be involved in the storage, management, maintenance and cleaning of the equipment. The assumption was that the students would ensure that the equipment was used because we believed they would enjoy doing the experiments and activities, and this assumption turned out to be true.

The presence of the kit not only ensured that experiments could be done in the classrooms but also served to encouraged teachers and resource persons to think

creatively and take the initiative in trying to replace expensive pieces of equipment with cheaper locally available alternatives.

Critique of HSTP – the Process versus Product debate

One of the most persistent points of criticisms of HSTP has been its insistence that experimentation by children should be at the heart of its pedagogy, sometimes even being elevated to the level of a principle – that no concept that cannot be developed through direct experimentation by students should form part of the middle school curriculum. After all, the critics argue, there are other time-tested ways of teaching science in which providing information plays an important role and that teaching only through experiments cannot be accepted as a universal pedagogical principle as there are innumerable concepts in science for which students in school cannot perform the relevant experiments. Also, they argue, evidence from Western countries in the recent past would suggest that activity based teaching is not as efficacious as it was earlier made out to be. Taken together this would appear to be a serious charge and merits a considered response not only because such arguments have been used to back claims that HSTP was an inferior programme thrust on rural schools but also because the idea that alternative approaches to experiment based teaching started finding support and resonance within Eklavya as well during the years just before the closure of the programme.

The first thing to assert is that science pedagogy based on experimentation alone was never propagated as a universal principle applicable across all classes and in all situations. It was a specific strategy adopted for teaching science in middle schools in the Indian context, a context in which there was no experimentation or investigative activity carried out by children in science classes, a context in which the overwhelming majority of schools did not have any equipment for experimental work let alone anything remotely resembling a laboratory, a context in which there was no difference between the ways in which science and history, for example, were taught, a context in which 50% of all students enrolled in Class 1 would drop out by the end of the middle school and of the remaining only a minority would choose to study science. In such a context we considered it of the highest importance that instead of stuffing the curriculum with information to be transmitted to students through conventional chalk and talk pedagogy, we should convey to our children ways in which they could themselves uncover the wonders of the world of science. It wasn't as if there were not enough wonders that they could uncover even in the materially deprived circumstances of their existence, provided we could open them up to the wonderfully rich natural environment in which their lives were embedded. This is what we set out to do and this is what we believe we succeeded in doing without doubt and in large measure. We considered it important that students be made aware of the nature of science and how it works instead of learning odd facts about science, which would in any case become obsolete by the time they reached adulthood.

Lack of experimentation in the classroom was and is almost uniquely an Indian phenomenon – a fact that is not appreciated by those who use studies abroad to support their criticism of HSTP. Also, in assessing the worth and relevance of studies carried out abroad, the difference in conditions prevailing there as compared with India is not appreciated. Most western countries had a rich tradition of experimentation and

investigation by children in the classroom. This was true even of the pedagogy in the West even before it became popular to talk of activity-based teaching – a situation way, way different from the one prevailing in Indian schools.

Another point of criticism was how critically the programme was dependent on the schoolteachers and how if teachers were absent from school or did not teach, learning in HSTP classes came to a grinding halt, whereas, so the argument went, in conventional classrooms which are textbook driven and without the HSTP emphasis on experimentation, children could read the textbooks and learn on their own. The question is, what do they learn? Facts? But what good is that except to pass exams? As far as science is concerned, no learning takes place unless it is based on experience.

Attempts were made to assess HSTP by comparing the performance of its graduates with students of the conventional programme in the Class X examinations and in most cases the difference was found to be not statistically significant. I would like to understand why should teaching for understanding also improve children's performance in conventional examinations. Why is this even expected? The conventional examination, as everyone knows tests mainly for memory recall and why should training for better understanding in earlier classes at all affect a student's ability to memorise answers to a set of anticipated questions to be answered in a conventional fixed-time examination?

Expand or die

After HSTP was extended to cover the whole of Hoshangabad District, there came a phase when the phrase 'either we expand or we die' began to be bandied about. Three possibilities for expansion were then considered: the geographical expansion of the programme over the whole State, or expansion into other subjects and developing an integrated curriculum for the whole of the middle school, or developing an integrated science curriculum for middle, secondary and higher secondary schools. After a series of meetings and discussions, Eklavya decided in 1984 that the geographical expansion of the Science Teaching Programme was what it would work for, choosing the intellectually least challenging option. It decided to take the middle school curriculum, that had been tried and tested in Hoshangabad District, and implement it unchanged in other districts with the ultimate vision of spreading the programme across the whole of Madhya Pradesh. Even if the intention was to extend the programme geographically a different model could have been chosen. The Delhi group had in fact suggested that geographical expansion should not be accomplished by merely replicating the Hoshangabad programme in other districts of the State but by spreading the philosophy of HSTP by seeding local initiatives, which would take on the philosophy and approach of the programme without necessarily replicating the same curriculum. However this did not find favour with the Eklavya group. Mechanical replication won over a more imaginative expansion. The NCERT model proved too seductive and beat out the possibility of developing a network of networks in which Eklavya would act as one of many nodes sharing a common vision rather than a common programme. Maybe it was a matter only of the victory of what was possible over what was desirable. Maybe it was based on a realistic estimate of the effort that would be required to set up such a network in the light of the difficulties experienced even in enlarging the HSTP academic group to a size required to handle effectively the tasks that kept arising even in its day to day functioning.

Kishore Bharati and Friends Rural Centre were rightly lauded for starting HSTP, but I believe they were glad to pull out when they realised the enormity of the task and the time it would take to make any significant and lasting impact on the system. Their spirits were not up to it, and in a sense the birth of Eklavya was precipitated by their reluctance to continue with what they had started. May be the decision in favour of geographical expansion was equally pragmatic, based on the realisation of the enormity of the task of seeding Eklavya-like institutions in every district. Where would the funds and more importantly, the people come from?

This decision was, however, a watershed in that it marked the beginning of the distancing of what remained of the Delhi group from the future organisation and running of HSTP. Decentralisation appeared to have become an empty dream. No one seemed to be prepared to work for it when the dominant paradigm seemed to be to wield more and more control over a larger and larger geographical area. The seductiveness of the NCERT model, the dream of changing the system centrally – one large battle rather than many skirmishes won out; but change, lasting change, appears not to work this way.

The Government

When the Madhya Pradesh government decided to pull the shutters down on HSTP, there were sustained and widespread protests in academic circles across the country, but it all proved to be of no avail. The government remained unmoved and made it known in no uncertain terms that they were the landlords and organisations like Eklavya were nothing more than mere tenants tolerated as long as the powers that be decided it was all right. Maybe they thought that Eklavya was not deferential enough, claiming too much credit for what was happening, after all, in government schools by government sufferance. May be Eklavya forgot that government policies change not only when a new political party comes to power or when a minister changes but can also change when one bureaucrat gets replaced by another. May be the decision to shutdown HSTP was as much to do with the change in the vision of the government bureaucracy in respect of its management role in the public education system as any educational reasons it trotted out to justify the closure.

Future

I think the end of HSTP also marked the end of an era in educational experimentation and change. Never again, I believe, will any programme of intervention in the education system be allowed the freedom to experiment with curriculum structure, textbook development, teacher training and examination reform that HSTP enjoyed. The times have changed and a new reality confronts educational reform in India. Given the Government's and NCERT's reluctance to cede control over curricula, it is unlikely that another programme like HSTP will ever again be sponsored by the Education Department of any State and the future for non-government intervention in the education sector looks bleak. The way forward would appear to be to accept the state curriculum as given and try to make science teaching more experiment driven within the

given framework. This is what UNESCO and its programme “Scientific and Technological Literacy for All” did in the mid 1990s.

The greater cause for pessimism is however the experience with erstwhile resource persons from HSTP working with NCERT in its last round of writing science textbooks from Classes 6 to 12. Instead of trying a decentralised mode of working with centres spread throughout the country they all agreed to be flown into Delhi and work out of there on a single set of textbooks that would be either used directly or act as models throughout the land. They did not protest when only a sprinkling of schoolteachers was involved in the writing, not even when experimentation in the science classes was made incidental to the whole exercise. They pressed for no trialling of the textbooks, no collection of feedback and, worst of all, no training of teachers in the new materials. This compromise on all issues with all that were dear to the Hoshangabad programme augurs ill for any meaningful reform in school science pedagogy.

Was this failure to use the lessons from HSTP in engagement with other programmes of curricular reform by resource persons with a long history of association with HSTP merely a compromise with the reality of the prevailing paradigm? This failure would appear to me to be a much more deadly blow to all that HSTP stood for than its actual closure in 2002.

Acknowledgement

Finally I must take this opportunity to thank and acknowledge the many colleagues who together constituted the Delhi group of the Hoshangabad programme, for the many weeks stretching into years of the most enjoyable and fruitful engagement that it has been my pleasure to participate in. The honour of being at the top of the list must of course and without doubt go to Pramod Srivastava, fondly known among the cognoscenti as the “Educator General of India”, without whose vision and persistence the group would probably never have come into existence. I would like to thank Man Mohan Kapoor, Natrajan Panchapakesan, Raj Rup, Vishnu Bhatia, Jai Dev Anand, K V Sane, V M Khanna, Dr Uppal, the Jaiswals, Kamal Mahendroo, Sadhna Saxena, Vinod Raina, Hriday Kant Dewan, and Anita Rampal who rallied to the call over the years. This is not to ignore or belittle the contribution of others but only to recall the names of those I interacted with most closely and put on record my thanks for the memorable times we had together.

Vijaya Varma