I INTRODUCTION

1.0 It was examination time. Bhaiyalal tat memorizing hard. The topic was 'preparation of oxygen'. Parrot-like he repeated, "One, by heating glass. Two, by heating potassium permanganate. Three, by heating ... . " The possibility of glass releasing oxygen was something new to us. The boy insisted, "Guruji told us that glass, when heated well gives off oxygen." His class notes, duly corrected by his teacher, confirmed his statement. We were puzzled. On going through his text book the mystery was solved. It said that oxygen can be prepared by heating the oxide of lead *(seesa).* The teacher applied his ingenuity to interpret *seesa* as *sheesha.* From *sheesha* to *kanch* (glass) was a short step. The oxide of lead fell by the wayside.

Takhat Singh was a brilliant student. The teacher liked to present him as an example to any visitor. One day we visited Takhat's school. With his teacher looking on proudly, he rattled off the names of different parts of a flower: calyx, corolla, anther, stamen, gynaeceum, carpel, ... onwards to the nucleus (the Hindi equivalents, of course). However, when a flower was placed before him, he was stumped.

These incidents, and many more like them, are first-hand observations in some village schools in Madhya Pradesh. Although they illustrate a serious malady in the teaching of science in particular in our country, it cannot be doubted that they are indicative of a more widespread disease in school education in general. After all, Bhaiyalal could easily be repeating more serious nonsense from history or economics texts, and the Takhats are unlikely to fare any better if they are confronted by a map after they have rattled off geographical and historical facts.

In our view of national development, and in particular rural development, a wide-ranging attack on such significant gaps between expectations and reality in education must occupy a prominent place. Why does a child have to memorize a whole range of unrelated and irrelevant facts in the name of science or social science? These facts often make little sense to the teachers themselves, and are seldom remembered beyond the examination. What use is terminology which conveys nothing beyond the imposing words themselves ? What use is an education that builds barriers between class-room learning and real experiences ? What use is information if it cannot be applied to solving practical problems ? Education must surely aim at developing skills and attitudes which enable students to learn directly from their environment and experiences in an enjoyable manner.

We also have to face some stark facts. Firstly, knowledge is growing exponentially; no-one can be expected to know or retain any significant fraction of it. Secondly, it is generally accepted that some 60 to 70 per cent of village children either do not enter the school system at all, or drop out at a very early age. Of those who do manage to continue through middle schools, a mere one-fifth enter higher schools in rural areas. Our present educational system caters to the privileged few. This to us is a contradiction, and educational objectives need to be redefined in this perspective.

It was with these ideas that the Hoshangabad Science Teaching Program (HSTP) was initiated in 1972 in sixteen rural middle schools of Hoshangabad district, with the help and support of the Madhya Pradesh Education Department. After a trial period of six years the programme was extended in 1978 to cover all the middle schools of Hoshangabad district. Today the programme covers nearly 250 schools, i.e. about 30,000 children, and involves over 600 village school teachers. A fuller description of the programme is attached (Appendix III).

Ten years have elapsed since we started the programme. In these ten years we hava learnt a lot: we have now a better understanding of field situations, and also of the obstacles and limits to the implementation of innovative ideas in education. After a debate that has continued for more than one year, we have decided to expand further the scope of such innovative changes.

It has become clear to us that if the ultimate objective of school education is to help produce a 'thinking' population, then the development of skills and abilities leading to a 'critical sense' cannot be confined to the middle school science curriculum : it must cover the entire school programme—sciences, social sciences, languages and mathematics—and all levels, primary to higher secondary. We have also decided gradually to expand these activities to the whole of Madhya Pradesh, so that Hoshangabad district does not remain an island, a showpiece.

1.1 **What does curriculum** change in **the social sciences mean ?**

One of our objectives in this paper is to raise precisely this as a matter for debate and discussion. Obviously, a prior question ought to be : "What is the objective of teaching the social sciences at the school level ? If we can answer this question, we may then be clearer regarding the kind of curriculum one must design.

It seems to us that any attempt to find an answer in the existing school texts in history, economics, civics, geography or political science is an unrewarding task. The descriptive nature of most of these texts, covering as they do a sweeping range of topics, places and times largely in an unrelated way, makes it very hard to arrive at any conclusion other than that their contents are meant to be crammed for the short duration of the examinations : if something sticks in the child's mind, it is an unexpected bonus. Certainly no sensible person could agree to this as an objective.

To our mind the question about the objectives of teaching the social sciences is related to the following question : "Is it important to know something about social forces so that an informed population can exert an influence on them, thereby helping to shape its destiny"? If the answer is 'JYes", then it is important to teach these subjects with such an objective in mind. It is this objective that we subscribe to.

With this as the guiding objective, in the succeeding sections we outline first some general principles regarding methods of teaching, and then present a tentative framework around which the curriculum may be structured.

II TOWARDS A METHOD **FOR TEACHING THE SOCIAL SCIENCES**

2.0 In what follows we attempt to set out some general principles which can form the basis of an approach to the teaching of the social sciences in schools. Our remarks are made tentatively, and with the aim of identifying problems and provoking discussion. It is no part of our intentions to lay down rigidly the lines along which all further discussion must proceed, or to foreclose further consideration of basic principles.

While saying this, however, it does seem to us that the ideas should be regarded as provisional less because further discussion at the same level of abstraction is likely to lead to major modifications (this may happen, of course)/than because experience with translating general principles into live teaching programmes will force revisions and rethinking. It is relatively easy to set out 'what we believe' in an abstract way; easier still to argue about it in an abstract way. The difficult and delicate job is ;o go from here to the class-room programme and activity. The real test will be the reactions of teachers and students, and ultimately it is the contribution of the teachers that will determine what is to be, or can be, taught.

2.1 **An integrated** approach

We regard most of what is said below as applicable to the teaching of social sciences through the entire school programme upto Class XII. Our immediate focus, however, is the teaching of children upto Class VIII. For this age-group we think that what needs to be fashioned is an integrated 'social studies' course, with no demarcations drawn between history, economics, civics, geography, etc. This will probably be regarded by most as the completely obvious thing to do for economics (which is in any case not taught at this level in the traditional system), or for the content of the civics course. The unconventional part of our proposal is that we do not envisage upto Class VIII any separation of history or geography either. It is this that may require some clarification.

Briefly, our reasons are these. What we wish to inculcate is critical, scientific

thinking about the actions of human groups in an environment that is the product of an interaction between social institutions and natural factors. One very important dimension of such critical thinking is precisely to approach problems in these terms, to 'see' (whether this is clearly articulated or not) the unity of diverse aspects of society and natural surroundings. The conventional separation of 'subjects' into watertight compartments of stores of facts militates against the development of such ways of thinking. In saying this, we have no wish to deny that, exactly as in the natural sciences, further progress requires a sharper delimitation of areas of concern and the separation of 'disciplines'. But here a second factor comes in. Upto Class VIM the formal development of the subjects (history, economics, etc.) as separate entities is completely ruled out for reasons which hardly nted discussion. The kinds of abstraction habitually employed in the social science disciplines require greater intellectual maturity than children in this age-group have- Given this there seems to us no virtue in maintaining distinctions that have relevance only in the context of the formal academic disciplines concerned : no advantages to weigh against the disadvantages mentioned above.

The case of geography will require further consideration. Aspects fall squarely in the area of the social sciences : the influence of natural surroundings on social organisation, and conversely the shaping of the natural environment by human groups. But there are aspects which can be introduced into a social studies programme only rather artificially. The answer, it seems to us, probably lies in dealing with these other aspects along with the existing science courses.

2.2 Critical learning vs. the memorising of facts

As a certain amount of heat has been generated quite recently over 'syllabusrevi-sion' and textbooks in relation to history, it is perhaps necessary to make some things clear at the outset. It seems to us that in much of the discussion on 'syllabus-revision' so far, attention has been concentrated on changes in 'interpretation* and shifts in the kinds of topics treated (thus, e.g., economic rather than political history). Very little of this discussion, if indeed any part of it at all, has concerned itself with the underlying teaching methods or the skills that the child is expected to develop.

Our concerns are rather different. At one level they are far more modest. No novel'interpretation'of Indian history is on offer for example: in fact the idea of substituting one'interpretation* for another, which the child is to learn up, is completely foreign to our aims. What we want to do is to develop habits of mind, ways of thinking about problems in the area of the social sciences, and to provide the student with some of the tools necessary for approaching these problems. To this end our primary concern is with teaching methods rather than 'syllabus-revision' of the conventional kind.

Prior to anything that one m'ght say about strategies of *teaching* is the simple question : "What does *learning* history or economics or any of the other social science subjects mean"? To this question first a negative answer—what in our opinion the learning of the social science subjects does not mean. We are firmly opposed to the idea that these subjects are basically bodies of information which need to be passed on; stores of facts which the student has to memorize and learn to reproduce faithfully when the occasion demands it.

Firstly, we do not believe that information can be *assimilated* in any genuine sense by the child without conceptual development. In the absence of the latter, 'learning'can amount only to the memorising of sentences (or, if the child is 'able', paragraphs and pages). Secondly, clearly the number of 'facts' is uncontrollably large and getting larger all the time : there can be no question of learning 'alt the facts' in the course of any formal education programme. What is required instead is really the ability to *acquire* 'facts' to assess the worth of pieces of information, and to use information to particular ends; not the mere learning up of comprehensive lists of 'facts' allegedly adequate to each stage of the educational process. But treating subjects as bodies of information, rather than as sets of methods and concepts, precisely militates against any such *active* grasp by the child; it does not provide the student with the wherewithal to ask new questions or to attempt answers to them.

Thirdly, and here we run into a problem that is not encountered in the same way in the natural sciences, in the social sciences the status of a 'fact' is often doubtful incorporating as it does selection, interpretation, particular viewpoints of observers, and judgements regarding the quality of evidence. It is an appreciation of these problems that allows sensible use to be made of the facts. It seems to us more important to develop a critical awareness of such problems than to encourage a fetishistic attitude towards 'facts' handed down to be learnt up. History, for instance, is not merely 'what happened in the past', but also how we learn about the past; more important, we believe that only an understanding of the latter allows anything worthwhile to be said about the former.

If the above is a negat.ve characterisation, what can we say positively about what the learning, and hence the teaching, of these subjects should be ? We start with the belief that *conceptual* grasp and development are primary in the learning of anything. This will probably be readily granted in the case of a superficially more 'scientific' subject such as economics which explicitly employs the language of 'assumptions* and 'models'. We believe, however, that it is equally true of history or geography. In fact it seems to us that it is in history that the most delicate problems arise. We believe further that allied to the grasp of such concepts is the development of skills. Under this latter head we have in mind both skills of a general intellectual kind which are used in all fields of rational enquiry (the ability to formu-

late a logical argument or to see gaps in logic in an argument, to sort out deductions from assumptions, to draw inferences, to interpolate intelligently when the information available is only partial, to extrapolate from a given situation, to synthesize different bodies of fact or argument); and some of the tools, procedures, methods specific to the social sciences. The development of skills and the development of concepts go hand-in-hand, for any skill is in part a skill in handling concepts, and concepts are assimilated only to the exent that they are used.

Secondly, we believe that concepts and skills are learnt only if the child is required to *use* them. Hence a fundamental principle regarding text and work-books must be to make them 'exercise-oriented' rather than 'fact-oriented'; similarly to orient class-room teaching towards getting the child to ask and attempt answers to questions, rather than to te//him or her things.

Thirdly, we believe that, the very best of intentions notwithstanding, no such learning process can proceed without the *active* participation of the child, and that such participation will not be forthcoming unless the child's curiosity is stimulated. We believe further, and this is the important point, that such stimulation is best ' achieved if one begins from the child's immediate environment. (We say'begins' adviseal because clearly one has to move outwards from this; all social science is concerned with generalisation beyond a particular set of social circumstances—and with locating the limits of generalisation in each case.)

These points have been put rather schematically and an attempt is made in the next section to amplify them. It seems worth saying at this stage, however, that these rather general principles appear to us to be in consonance with the researches of educational psychologists. Also our own experiences over ten years with science-teaching in this age-group, as well as experiences with non-formal education, appear to us to confirm their validity.

2 3 Concept learning in the social sciences

The emphasis on 'concepts' may seem to some as out of place, particularly in the teaching of history to school children. Is this not simply a matter of narrating events in a sequence ?

We think, however, that on a little reflection it will be agreed that this is much too naive a viewpoint. Any narrative will contain words which embody complex ideas: 'nation', 'nationalism', 'democracy', 'economic development', 'industrialisation', to say nothing of 'economy' or 'society'. The meanings of such words shift over time and between different contexts, precisely because they are where a variety of concepts, ideas meet. It would be idle to suppose that their meanings are self-evident to the student, often idle to suppose that their meanings are clear at all. Any

narrative, moreover, knits together various such elements, and in any such knitting together a host of connections, more or less complex, are presupposed. All this needs to be brought out, and it is this sort of thing that we mean by 'conceptual development'. In fact, in one sense at least, the problem is much more acute in history or economics than in the physical sciences. The translation of a concept into a particular experimental situation is generally impossible, and so very often one way of arriving at a concept, as a generalisation from particular situations, is not available. The concepts these subjects use are more 'abstract'.

Starting from here the argument has often been built up that these subjects are not suitable for chilcren under, say, *sixteen* except in a semi-anecdotal form. This argument goes thus. The intellectual development of younger children is not sufficiently advanced to permit their going beyond problem-solving in terms of what is immediately apparent. They cannot cope with abstract concepts and with hypotheses cast in term of such concepts, with 'formal operations'. The past cannot be grasped directly; the ideas of time and change are too difficult; the method of history is beyond their grasp—children cannot cope with tentative and provisional judgements based on incomplete evidence, in situations where designing simple experiments to eliminate hypotheses is not possible; they cannot handle problems with a large number of variables; and so on. Consequently the attempt to develop conceptual understanding must be abandoned altogether: we regress instead to 'the telling of a good story', relying on the 'natural curiosity' of children about the past or different regions, and to the providing of 'food for the child's imagination'.

The position of a sceptic advancing such an argument differs, of course, from that of someone who simply does not acknowledge the conceptual difficulties. Nevertheless, while recognising the validity of the 'sceptic's' starting point—the conceptual and other difficulties involved—we believe that a *start* can be made much earlier than the age of sixteen, and that one does not have to take the position of 'simple facts for schools, interpretation and a critical understanding for college students'.

In saying this, however, a clarification of what we mean by 'conceptual understanding' is necessary. Our position is that the child—or for that matter the adult— gradually *enriches* his understanding of an idea, rather than arriving at one stroke at a concept or skill in full bloom. So we do not visualise a'linear' progression through a list of skills or ideas; rather, teaching will have to concern itself with producing a *growing* understanding of any particular concept e.g. nationalism or economic development. All the difficulties the 'sceptic' pointsto are real. What they will force on us is a careful consideration at each stage of what is possible: but we do believe that an 'intellectually honest' start can be made as early as Class VI without regressing to 'story-telling' or, worse, requiring children to commit meaningless jumbles to memory. Similar problems have been confronted in the teaching of the physical

sciences, for example in relation to the ideas of *mass* (as opposed to weight) and the *atom;* and there a decision was made to defer the discussion of these ideas. Undoubtedly analogous decisions will have to be made with the social sciences as well.

What relation will there be, if any, between the development of the school programme and the professional academic disciplines (history, economics, etc.) ? Some clarification is probably necessary because the repeated use of the word 'concepts' msy give rise to misgivings. We think that one useful lesson to be learnt from the position of the 'sceptic' above is that certainly in Classes VI to Vlll, there is no good reason to believe that the logic and quirks and compulsions of the *academic disciplines* should be the main guide in fashioning the *school subject.* Of course, in aporoaching material to do with the social sciences, some of the preoccupations of and some of the ideas daveloped by the academic disciplines will find a place. But the attempt is not, and cannot be, to set in motion the first stage in the production of professional historians, economists, etc. Just as in school mathematics discussion of the trigonometric functions is not deferred on the grounds that the theory of power series has not been developed, so also here. University economics may scrupulously avoid all mention of money in courses which ostensibly deal with exchange and markets, on grounds of logical development or simply out of perversity. We see no good reason to follow such examples of 'rigour'.

2.4 Some remarks about method

The final set of general remarks concerns some aspects of method. In the teaching of the natural sciences some general principles that have been adhered to are :

(i) avoiding as far as possible *telling* the children the 'facts' or methods or concepts, and relying instead on the 'generation' or 'discovery' of information by the students themselves—obviously with guidance;

(iij using experiments as the major tools for such 'guided discovery'; (iii) using the local environment and locally available points of reference.

How far can we go in th$ social soionces with these principles ? It seems to us at this stage that the character of the social sciences will necessitate some Shifts in balance. These are subjects which are intrinsically 'comparative* in the widest sense. First, their whole thrust is (from the outset) to go beyond the immediate social environment. These subjects start with the realisation that there are differences in social forms, that one's own social reality is not the only possible one ('obviously so', 'God-given', etc.), thus leading to the initial questions which lead in turn to the fashioning of concepts, msthoos of enquiry, etc. The concepts that these subjects

employ are 'abstractions', specifically intended to deal with different social environments. Secondly, controlled experimentation is ruled out, giving way to 'controlled investigation' and the use of the 'comparative method' in drawing conclusions regarding hypotheses.

All this necessitates an input precisely of the kind of information which is not available in the immediate local environment, and which cannot be generated through the design of experiments which the children can themselves undertake. A different balance will therefore have to be struck between 'information-giving' and 'information-generation'. Moreover, it would be necessary to devise ways of conveying information about other regions and countries and periods so that the variabilities of historical situations are not lost sight of. For this purpose the extant 'anecdotal' mode may be utilised imaginatively and more meaningfully.

Nevertheless, we begin with the belief —which field experience in future years may or may not validate—that the following axioms of the science teaching experience can be preserved :

(i) We lead up to concepts through questions the children are provoked into asking, even if the answers cannot always take the form of direct experimental observations.

(ii) We start always with the child's own experience and the local environment, aspects of which can be used to stimulate active curiosity—to which 'information-giving' can form a natural sequel, rather than being simply more drudgery, as unfortunately it often is.

(iii) Even in the case of information that is 'given' rather than generated', activities should be based on such information to make the assimilation more analytical and less mechanical.

This is the minimum. In fact we are rather more optimistic about the possibilities. A number of skills (data collection and classification for example) can be developed perfectly well relying entirely on the local environment and the activity of the children. Again some aspects of the rural environment (for example, the co-existence in a small area of a wide spectrum of technologies, or the immediacy of production activities) can be turned to advantage.

There will undoubtedly remain a large residue that cannot be dealt with through activities or 'environment-based' methods. Here some lessons can be learnt from the science programme which has already confronted in particular cases the problem of having to deal with subjects for which suitable experiments cannot be devised. An open-ended chapter on'Living and Non-living' in the present science text-book is one such example; this chapter is appended as a possible illustration of methods which we might use in the social sciences (Appendix II). Our experience is that this

chapter succeeds in provoking intense curiosity and attention in the children, and if this can be matched by the corresponding chapters in any social science text-book, that alone will be a signal success.

We are painfully aware that many of the remarks made above might seem to oscillate between the banal and the obscure, because they have been put very abstractly! In one of the appendices (Appendix I) we have attempted to show concretely how the method we have in mind might work in an actual class-room setting, and we hope that such an example will carry more conviction.

III A TENTATIVE FRAMEWORK FOR THE CURRICULUM

3.0 We present here a tentative framework within which the material to be presented can be organised. Implicit in'the framework is the absence of any sharp demarca tions between what is 'history', what is 'economies', etc. The guiding principles are basically :

(i) It is as important to know how people lived in certain ages and what happened to their *societies* as it is to know the dramatic political episodes. We seek, therefore, to get children concerned with how people live in society, how their economic, political and cultural lives are organised and how they interact. The information to be provided to this end can range over various times and societies, including contemporary material.

(ii) No aspect of social reality can be fully understood in isolation from other aspects; there is, moreover, a need to widen the field of enquiry in order to enrich our understanding of social life.

We visualise the organisation of the material to be covered under the following broad heads: (a) man and nature; (b) economic processes—technology, the organisation of production, exchange etc.; (c) social institutions and organisation, culture; (d) political institutions and movements.

3.1 Man and nature

Under this head we expect the children to begin by observing consciously their own natural surroundings—hills, plains, rivers, forests, natural resources, climate. The observations should be so organised as to lead them to discover the ways in which natural surroundings affect the lives of people, and how people in turn transform nature. They can be 'guided', for example, to see the relationships between natural and climatic conditions and ths types of dwelling used, food and clothing; between forest or water resources and foods, fuel, building materials, modes of transport; terrain and types of agriculture and patterns of settlement; etc.

This exercise in 'discovery of the environment* can then lead to the provision of information (through illustrated maps and pictures as well as descriptive texts) about other regions and times : the thrust of such information would be to provide the children with a wide variety of man-nature interactions. An imaginative tackling of the theme can lead to the generation in the minds of the students of hypotheses about the springs of human thought and action; most significantly, they can begin to question and investigate the ways in which the external world has shaped, and has been shaped by its interaction with human beings and their minds; one can also begin to approach the links between this man-nature interaction and social reality at large.

The development of this theme will necessitate the teaching of various techniques (maps, graphs, data collection and analysis, etc.). Much of the information that is communicated descriptively through the traditionally structured courses on geography and history will also be 'covered'. The fundamental difference that we wish to see is that the imparting of such information or techniques follows the stimulation of the child's curiosity.

3.2 Economic processes

Some idea of man's interaction with the natural world would provide the basis for observing and enquiring into economic processes. Here again, a start can be made from the directly observable. An easy point of departure is the observation of articles of consumption, perishable or durable, in the children's own homes : this can then lead to questions about how these articles are acquired—are they directly appropriated from nature, are they produced by people in the same locality, are they 'imported' from outside, etc.

The various sub-themes that can be studied in order to illustrate the nature of economic processes are as follows :

(i) Land and cultivation : crop patterns, techniques, the organisation of fields, how people interact in the process of production, etc. An over-arching objective could be the development of the idea of a system of production: the connections between the environment, technologies and social structure.

(ii) Industry and handicrafts : the distinctions between agriculture, handicrafts and industry; the division bstween town and country; occupational division and categories; the ideas of specialisation and division of labour; the connections between different spheres of productive activity.

(Hi) **Trade** and money. Observations of the weekly market *(hat),* mandi, shops, peddlers can be directed towards questions relating to the types of goods

bought and sold, who buys what, the particular timing and spatial distribution of markets, the role of media of exchange, who are engaged in these activities and how they conduct their business; and towards the connections between the local environment (natural resources), transport and communication, incomes and demand, the availability of skills and the supply of different goods.

(iv) Transport. Again direct observation of alternative modes of transport, and who operates and controls them, can lead to questions such as the effects of different modes of transport on the lives of people in terms of migration, regional specialisation, the availability of different kinds of goods, the social effects of modern means of transport, the 'cultural' effects in terms of conceptions of space and time, etc.

(v) Technology. Observations of the skills and techniques used in agriculture, industry, transport can be taken up for closer scrutiny so as to gain an understanding of how methods emerge and change, and how skills are preserved and transmitted. Once again, the larger aim would be to make children see through technology the history of the interaction between various elements of social life. Starting with the plough for example information can be provided about its emergence and evolution, and can be broadened into information about the different technological stages that human societies have traversed (the neolithic, industrial 'revolutions', etc.)

In developing these themes the information conveyed can cover both contemporary and historical practices and structures; in the process large chunks of present history syllabuses as well as descriptive material regarding the contemporary Indian economy can be dealt with. The thrust, however, would be different in that the primary focus would be the'concepts'(production, exchange, distribution etc.); so also would be the methods used—the children would 'discover' the concepts as useful analytical tools for understanding important aspects of the human world rather than as a set of mystifying semantics.

3.3 Social structure

(i) Family and community. Again, starting from immediate observations of family and community, one can move outwards so as to make the children conscious of structures of authority, divisions of functions, patterns of human relationships (the immediate family, relationships of extended kinship, communities not based on kinship), the place of family and community structures in sustaining the psychological, moral and social world of a people.

(ii) Social institutions. The children could be made conscious through observation and discussion of such institutions as schools, law courts, hospitals and medical services; who has access to them and how they are administered; what their social 'functions' are.

(iii) Social mores and modes of behaviour. Every child is born into patterns of behaviour, but few are ever encouraged to ask rational questions about them : we would like children to become conscious of their modes of behaviour by focussing their observational abilities on rituals, dresses, foods, religious ceremonies, places of worship, social festivals; their connections with the life-cycle or production cycles; the functional values of rituals and festivals; how they come into being and how they survive or change or decline; how they interact with other areas of social life, the cohesion they may provide to a community, the ways in which they may reinforce other divisions or structures, authority, etc.

3.4 Political processes and institutions

Under this head too, we would like children to become curious about and to question, things that they might be aware of without ever fully examining: institutions such as the panchayat, co-operative societies, etc.; administrative agents at the village, tehsil and district levels, functionaries associated with the electoral process, what political forms (democracy, for example) can or do mean in terms of the daily lives of people, how they are translated into institutions at both local and national levels; the relations between political forms and institutions and social or economic life. An emphasis on contemporary material can enable the incorporation of much that is taught as 'civics*; at the same time historical material will serve to set present institutions in perspective, and allow questions to be raised about evolution and change.

IV. CONCLUDING REMARKS

4.0 An understanding of social events and structures does not mean that certain 'facts' have been memorized. It ought to mean that certain ways of thinking about problems in the social sciences have been acquired; that the ability to deal with these problems in an organized, scientific, systematic way has been developed. The most important step toward this is the replacement of unreasoned and emotional judgements by objective, rational analysis.

In general terms what would we like the school curriculum to achieve? Schematically :

(i) The development of a consciousness in the child of the social environment, so that it can become an object of discourse and questioning, rather than being simply something that is unconsciously lived through.

(ii) The development of the fundamental idea that this is also an area of enquiry in which standard scientific questions can be asked. Why is something so ?

What is the connection between different phenomena ? Why have implements taken this or that form in different periods and places ? Why has railway development in this country followed certain routes ? What is the connection between railway development and crop patterns ? Related to this is the development with regard to social life and events, of habits of scientific and critical thinking, asking tor evidence, asking how reliable it is, and so on.

(iii) The development of a sense of historical evolution, and of a feel for some of the typical problems that arise in any scientific pursuit of historical or other social enquiry: thus, a realisation that 'evidence' in this area almost incorporates a viewpoint or bias, or a realisation that very often the evidence is of a character that does not permit conclusive judgements even in excluding hypotheses.

To these ends obviously the child will have to acquire certain skills (the ability to interpret statistics, read and draw maps, interpolate and extrapolate using graphs and other tools). He or she will also have to develop conceptual understanding : what is a 'nation', what is 'economic development', etc. We are aware that such understanding would inevitably involve questions of interpretation. But we feel that our proposals would make 'interpretations' also open to critical analysis and rational discourse, so as to ascertain their relative plausibility and empirical validity.

To develop this grasp of whatever is'social'about human behaviour, a student must have adequate opportunities to observe human affairs and must be encouraged to ask the sorts of questions that a social scientist might ask. We believe that using the child's own environment as a starting point, a gradual process can lead him or her to reason abstractly and to consider social forms in the large. After all, 'social* implications can be readily found in the conduct of everyday human affairs. These arguments suggest that the environment-based enquiry method (the 'guided-discovery' method) that we have used in the HSTP can be suitably modified and adapted for social science teaching. Obviously, however, this adaptation will evolve on its own, through trial in the field, as has the HSTP methodology,

4.1 In view of our repeated use of the word 'scientific', as well as of the fact that the background to our present attempt has been the development of a curriculum for the natural sciences, it is probably necessary to digress a little to allay any misgivings.

We are more than aware of the debates about methodology in the social sciences. Much has been written about whether these disciplines can properly be termed social *sciences,* and about the appropriateness of procedures evolved in the physical sciences. Some have asserted the power of tools and modes of analysis borrowed from the natural sciences in comprehending the social world, while others have vehemently denied it. This is not the occasion to go into the labyrinths of these

debates. We wish simply to propose the following. First, we do not think that an either/or position regarding the usefulness of natural science tools and procedures is tenable. Secondly, we do not regard the application of natural science methods to the social world as the test of the scientificity of social enquiry. The test is rather in the approach towards the investigation of social reality, and whether an attitude of critical curiosity is adopted towards the phenomena to be investigated.

We are fully aware of the more obvious difficulties in bringing to bear certain established modes of scientific investigation, such as controlled experimentation, to social matters. Nevertheless, we feel that children can be made aware that observation and acquisition of information can be made more systematic, its analysis can be more satisfying to the demands of logic, and that conclusions derived from this exercise can be made more secure and yet open-ended, than existing methods and text-books might lead them to suppose.

It is our belief that if we wish to produce students who can apply the skills of social science analysis to situations outside the formal curriculum, the above criteria must be made a part of the teaching methodology.

APPENDIX I

Below are two examples where an attempt has been made to employ an 'inquiry method' to the teaching of social sciences. Neither are model chapters, nor do the exercises cover the necessary informational ground of a particular topic. They are partial and experimental exercises meant solely to generate further thinking as to how sensible and meaningful teaching methods may be created for the social sciences. In the first example, a text and a photograph describing an excavation site are used. In the second example, an edict is reproduced in an edited form.

The problem of how to integrate information-giving with information-generating exercises is unresolved, particularly in the first example where the introductory information reads very much like a traditional lesson. There is also the problem that questions must be developed in a series so that, through the exercise there builds up a complex and integrated picture which indicates historical processes or economic and ecological principles.

Example 1

This lesson is about people who lived in this area (Narmada Valley) 3,600 years ago and who set up the first known villages in the Narmada Valley. We know about them from remains that have bsen found at their settlement at a place called Navdatoli. They did not write; but remains of their houses, pots, knives, tools and rubbish pits have been found. A specially trained person, called an archaeologist, can examine these remains and then tell us something about how these people may have lived so long ago. The archaeologist, H.D. Sankalia with his team, studied the remains of the Navdatoli people.

What they first found at Navdatoli was a raised mound. Such mounds have also been found at sites in Mohenjo-daro and in West Asia where people lived in settlements very long ago. In these settlements, when houses wear out or break down, it is easy to build new houses on top of the old floors. Gradually in this way the area of living rises above the level of the fields, forests and pasture lands, to form a mound. Objects used and handled by our ancestors can be found on the surface of the mound and also inside it. When the archaeologist digs carefully, straight down, it is possible to find different layers of settlement. At the bottom we find houses and objects used by people who lived 3,500 years ago. At the uppermost level we find remains of people who lived SCO years later.

Imagine an examination is going on in a classroom. Each student is supposed to have his or her book on the teacher's table as they finish. Later, when the teacher looks at the pile of books she can tell that Anil finished first because his book is at the bottom of the pile. In fact she can tell the order in which each student finished answering the paper. Similarly at Navdatoli, achaeologists have found six or seven floors of settlements, on top of each other. Some are separated from each other by layers of burnt clay and ashes, and the objects and building materials found in some layers are found to be different. On the basis

of these things, archaeologists have divided the 300 years of human life at Navdatoli into four cultural phases.

Inside the layers of the mound, H-D. Sankalia and his team found remains of the Navdatoli people ; remains of houses, clay pottery with beautiful designs painted on them, tools made with a cutting edge, a few copper but mostly large round stones, for hunting with slings, grinding stones, beads and bangles, grain seeds and animal bones.

Only one house has been found in phase II (sea picture) which has some portion of its walls still standing. Otherwise the only trace left of houses are beaten earth floors, sometimes covered with lime, and post holes around it in which the poles, supporting walls and the roof must have been fixed. From the arrangement of the holes, we can tell that the Navdatoli people lived close together in a village. It also seems that their houses were mostly of a single room, circular or rectangular in shape, and ten feet in length or diameter. The earth of the floors is river silt and gravel beaten down and, especially in the first and third phases, it was covered with lime.

Of their food sources, we can guess from grain seeds and animal bones found at the site. A very great variety of seeds; wheat, rice, moong and urad dal, linseed, peas and leguminous weeds were found. This is the richest variety of seeds found from any settlement of the period. From this we can conclude that the Navdatoli people practised cultivation. This was at a time when in practically all other parts of the Narmada valley people lived either by hunting-gathering and breeding animals alone. Of the crops grown at Navdatoli only wheat required digging by plough. All other crops were sown in the wet silt of the river, and rice in bunded ponds. Bones of goat, sheep and cattle found at the site show that milk could be had. Bones of fish and pig suggest that meat was also eaten.

By examining the stone knives and hammers, Sankalia concluded that the Navdatoli people used these stone tools to cut wood, harvest grain, grind it, clean hides and cut meat. Sometimes the stone blades were fitted on to wooden handles, Sankalia's team actually used some of the stone blades for cutting grass, wheat etc. to confirm their ideas.

Not much is known about their religion, but figures of a female form have been found which are similar to the mother goddess figure found at the Indus valley sites of Mohenjo-daro etc. and in other very early sites of West Asia. This figure of the mother goddess was worshipped in those cultures as a symbol of fertility, so that many children and plentiful harvests would be borne to the people.

Tha Navdatoli settlement and that of Maheshwar on the opposite side of the river are the only two major permanent settlemsnts found for that period in the Narmada Valley. The rest of the people who lived there were hunter-gatherers or pastoralists, who constantly moved from place to place and did not live in any stable settlement. In Maheshwar and Navdatoli people could live in one place because they grew their own food, by cultivation The geographical location of thase sites was suitable for agriculture. Cultivation requires fertile

soil and water. In most other parts of the valley the Narmada has very steep and narrow sides on which cultivation and irrigation were impossible then, with the tools andtechniques people of that time possessed. Other areas were heavily forested. At the point of Navdatoli, the river valley flattens out into a plain more then eight miles broad. Here the Narmada slows down and deposits loose soil and stones that it carries down from the mountains. The settlement itself is on slightly raised ground, above the river, which would protect the humans from floods.

Some historians have suggested that perhaps Navdatoli and Maheshwar became i mportant settlements beca use they lie at points along trade routes between the northern plain and the Deccan, where the Narmada can be easily crossed. But there is as yet not enough information to support this conjecture, especially as the needs of the Navdatoli paople seem to have been fulfilled entirely by their local surroundings.

We now give below a set of questions in an attempt to transform or convey some of the information of the 'lesson' above into exercises through which the child may 'discover' the imperatives of early Neolithic cultures and compare it with his own, and perhaps understand the process of historical development:

1. Look at the pit where you throw the rubbish of your house. Make a list of things you find there, which you think will survive even after TOO years : plastic bag, charred grains, broken *tawa,* glass pieces, bones ; add to this list from your observations.
2. What plants did the people of Navdatoli eat ? What do you, who lives in the same valley, eat today ?
3. In what vessels did they cook their food ? What vessels do you use today ? Explain the difference, if there is any.
4. With what materials or tools are the following tasks done :

	NAVDATOLI	TODAY
Cutting wood		
Peeling vegetables		
Crushing grain		
Carrying water		
Cooking rice		
Crushing oilseeds		
Decorating one's body		

Name some tools the Navadatoli people used which you do not use.
We use different tools to cut wood and plants today, made of metal with cutting edges.

5. Are our tools more efficient than stone blades for purposes of cutting ? Why ?
6. Why did not the people of Navdatoli use our kind of tools ?
7. Do you know if anyone can still make or use flaked stone tools ? Or hammer stones ?
8. Can there be any advantages of using Navdatoli type tools to present day one's ?
9. Can you guess how people may have shifted to using other types of tools than those of Navdatoli ?

(Note : Similar questions could be raised for the .use and change of clay pottery or building materials, pointing out what types of techonology survive and why. A Bhlll study of the area shows that as late as 1866, they used only clay potterv).

10. Picture study: Appended you shall find a picture of a half broken house at Navdatoli.
11. Identify, with names, the objects that have been used to make the wall ? What materials are they made from ?
12. How are the sticks fixed to the poles ? Historians and archaelogists do not know what fibres were known to people and used by them at that time. Can you guess. What methods may have been used when perhaps ropes were unknown ?
13. Would you fix the bamboo sticks to the poles in a different way today 7 How ?
14. Can wooden poles and bamboo sticks of such equal length be found in nature ?
15. If they are naturally unequal, how must have they been made of uniform length ? In the period when the house in the picture was constructed, no iron tools were available. Yet we see that the wooden poles were cut to equal size. How must they have been cut ?
16. From where must the following materials for the house have been got:
Wooden poles, bamboos, silt for floor, wet mud plaster ?
17. How long and broad do you think the room in the picture is? How will you try to guess ?
18. How many human beings and animals could have lived in such a house ?
19. Identify the objects lying on the floor of the house and guess the use for each object ? What material do you think these objects are made of ?
20. Do you find similar objects in your home now ?

21. From the archaeological analysis of remains, can we know :

(a) What the Navdatoli people looked like ?

(b) Their names ?

(c) The ornaments they wore ?

(d) The language they spoke ?

(e) The names of their gods ?

Example 2 :

We can get information about the past from another kind of source. The people at Navdatoli lived in an age when writing was not known. They belong to pre-history.

For literate societies of the past, written sources can be used, if we can decipher and understand the language used in the past; this constitutes historical research. Let us see how we can use a message written on behalf of a king. We will find out certain things which archaeology cannot tell us, but not about other things which archaeology does tell.

In about 300 b.c. (About 3,000 years after Navdatoli), a king called Chandragupta Maurya ruled in Patliputra on the Ganga, near modern Patna, in the region of Magadha.

He began to enlarge his kingdom, by fighting wars, to the south and north-west. He had a huge arm/, and was successful, especially in defeating the Greek rulers in Punjab. His son, Bindusara, also fought many wars, taking his armies south upto Karnataka.

In those days, Magadha was a flourishing area and the capital was a rich and luxurious city. Many foreignars admired it. Kings like to expand their kingdoms into regions which have good crops or forestry or mines, or busy ports and markets. In this way, they can increase the flow of goods to their capitals, levy more tax on trade and manufacture, and gain from importing goods from foreign lands. If they can trade with profit and safety with friendly people, kings may not need to conquer them.

South India was a wealthy region with mines of iron and gold, many sea ports and pearls. But, to tap the wealth of this region, the Mauryas would need to have safe, quick and easy access to them. Good routes mean that imported goods, grain from tax, and metals from mines can come to the capital cheaply. Kings build roads, so that traders, officers and tax collectors may travel fast from one part of kingdom to the other.

But in the region of Orissa, the kingdom of Kalinga was powerful and equally ambitious for power. The Mauryas could not tap the wealth of Central and South India with Kalinga in their way.

Bindusara's son, Ashoka (who called himself 'Piyadassi', the beloved of the Gods) fought a bitter war and defeated Kalinga. Now the empire was secure, but Ashoka felt

guilty about the bloodshed he had caused. Ashoka became a Buddhist because he liked the idea of non-violence and did not approve of wasteful rituals conducted by the Brahmins. Buddhist monks therefore remembered and passed on many stories about Ashoka and his fights with his brothers, his wickedness before he became a Buddhist, stories about his mother and so on. These stories, being passed from mouth to mouth over centuries, would have changed, and produced distortions.

But Ashoka has also left behind records which cannot be altered. At many places, all over his empire, in Gujerat, in Gandhara, in Bihar, in Central and South India—wherever he toured—he had his ideas engraved, written on rocks and pillars. In these writings, he told people about his idea of 'Dhamma' (dharma), and also about his power. So that all people could understand his messages, they were written not in Sanskrit, which only Brahmins understood, but in Prakrit, the language spoken by ordinary people. Ashoka felt he could keep all the different people of his kingdom united if they would all follow the rules of his Dhamma. Here is what he says in one of his inscriptions (250 b.c., 13th Major Rock Edict, edited version. Girhar, Dhauli Jangad, Ganjam district; Kalsi).

> "King Piyadassi, Beloved of the Gods, conquered Kalinga after he had been ruling for eight years. 150,000 people were deported, 100,000 killed and many more died.
>
> After this, after Kalinga was annexed. King Piyadassi earnestly practised and taught Dhamma. He felt remorse at the killing and deportation. It weighed heavily on his mind, as even good people in Kalinga, like brahamanas and sramanas, or other sects, or people obedient to their mother and father, people respectful to their teachers, and people kind to their friends, relatives and servants, also suffered. King Piyadassi believes that those who have done wrong must be forgiven as far as it is possible and he forgives the forest tribes in his kingdom, and does not wish to harm them. But he warns them that he has power even though he repented the bloodshed in the Kalinga war.
>
> King Piyadassi believes that victory by Dhamma is better than victory by war. He has conquered by Dhamma in all directions for 600 Yojanas (1500 miles)—where Greek kings rule, in the south where the Cholas and Pandyas rule and upto Ceylon. In his own kingdom, among the Yonas, Kambojas, Andhras, Bhojas, Patinikas, people follow his instructions in Dhamma.
>
> This inscription has been engraved so that any sons or grandsons that King Piyadassi may have should not think of fighting wars but of spreading Dhamma."

1. Why did King Piyadassi inscribe his feelings on rock 7
2. In what other ways could he have spread his message ?
3. Why was he sad ?
4. Did he believe in total non-violence ? Was he a weak king ?
5. Because he was a Buddhist, did he hate Brahmins ?
6. When he gave up war, did he give up his political power ?
7. What did he consider to be good behaviour ?
8. Who were the peoples living in his empire ?
9. From this edict, do we know :
   a) How people built their houses then ?
   b) What crops people cultivated in the countryside ?
   c) What the people expected from a good king.
   d) Whether people liked Ashoka or not ?
   e) What Ashoka considered to be a good king ?
10. Do we get information about Ashoka's time from :
   a) What people remember about him ?
   b) From objects that can survive burial in the soil ?
   c) What the king wanted people to know about his rule.

Note : This is obviously not a very nice way of teaching using primary historical material. How would you reconstruct this 'lesson' to make it more 'enquiry' or 'discovery[1] based ?

Historical reconstruction could begin by asking children to write their family and village histories, using oral sources. A comparison of the account written by each child about his village with that of the others could generate a discussion on 'selection of facts' etc. Do you have further suggestions for using the immediate environment of the child for teaching purposes—please keep the rural background in mind.

APPENDIX II

LIVING AND NON-LIVING (A chapter from the HSTP workbook for class VIII)

Of all the things around you, you normally assume some to be living and the rest to be non-living. You all know that a dog is living and a stone a nonliving object.

Think awhile and make a list of animals, trees and plants and other object* around you,. The longer this list, the better.

Make two sets from this list, 'living* and 'non-living'. (1)

Identifying living

Make a list of all those properties that you chosa as the basis for making the the set consisting of living objects.

Observe this list of properties again and tick those properties that you have studied in previous chapters. (2)

Is it necessary that a living object must exhibit *all* these properties, or can we call an object living if it exhibits only a few of these properties? Let us consider this question in some depth.

Will you call plants and trees living or non-living 7 (3)

They can not move from one place to another on their own.

Is it still proper to call them living ? Answer with reasons. (4)

Think of different seeds, like that of pea, beans and paddy.

From your list of properties of the living, which properties do these seeds have ?

a) Do they eat food ?
b) Do they grow ?
c) Can they move about on their own ?
d) Do they breathe ?
e) Do they reproduce ? (5)

On the basis of these questions, should we consider dry seeds to be living or not ? (6)

You know that plants are produced from such seeds, which in turn again produce seeds.

Do you yet feel some hesitancy in calling dry seeds living ? If yes, express it? (7)

Compare dry seeds with boiled seeds. Can we call boiled seeds living—explain with reasons ? (8)

Does a child grow continuously after birth ? (9)

Does an adult also grow continuously 7 **(10)**

Try to remember whether your parents have grown in height in the last three to four years ? (11)

In this period, how much height have *you* gained ? (12)

Do trees and plants also stop growing taller alter they have reached a certain height? (13)

Just because plants and trees and humans stop growing physically after a certain age, does it mean that it is wrong to call them living? Give reason for your answer. (14)

You must have noticed that in summers and winters, frogs are not seen much, but, during rains they are all over the place. Progs go underground (hibernate) during summers and winters. They neither eat nor move about. You may see such frogs if you dig before the monsoons.

Will you assume such froqs to be living ? Answer with reasons. (15)

You must have heard about 'sadhus' who **go** into a 'samadhi', buried underground For the duration of 'samadhi' they neither eat, drink or move about.

Will you assume these sadhus in such a state to be living 7 Explain with reasons. (16)

On the basis of examples given above, can you say that if *alt* the properties of 'living* are not present in an object, it could still be a living object ? (17)

Would it be proper to call an object non-living by merely checking on a single property ? Give reasons for your answer. (18)

In order to detetmine whether an object (like dry seed) is living or not, is it necessary to study its properties at different times and in different states 7 Explain with details.

Non-living Dead Of the following objects make two sets labelled 'living' and 'non-living': cow, and mosquito, brick, freshly fallen leaf, glass tumbler, bed-bug, fish out of water, scissors, banana, wheat seed and a piece of sugarcane with a node. (20)

Do you feel some problem in placing some of these objects in either of the two sets ? (21)

Can this problem be overcome by making another set 7 (22)

Place the objects in different sets again. (23)

What property did you choose while making the third set ? (24)

Such objects that are no longer living but ware so at some point of time are called 'dead'.

Exercise Which of the following sentences are right and which ones are wrong. Answer giving reasons.

a) Living objects can always move from one place to another on their own.
b) Boiled wheat seeds are dead.
c) A broken egg is dead whereas an egg in a nest is living.
d) Dead objects at no stage had properties of the living.
e) A rose stalk is not dead.
f) Boiled rice is living.
g) Fungus (that you see on pickles sometimes) is dead.
h) A flower on a tree or bush is not living. (25)

Relation between living and non-living You must have either made carbonic fertilizer yourself or seen it made. Write in brief how this is made. (26)
In order to increase production, a farmer quite often plants a fibrous plant called'sun'in his fields and as they grow, ploughs the fields. After a few months where do the ploughed plants disappear? (27)

Similarly, what happens to animals after they die? (28)

If a dead rat or some other dead animal is buried for a few days, what would be the state of its dead body? (29)

From these examples what relationship can you see between the living, nonliving and dead? (30)

You of course know that a need for good and healthy crop is fertilizer. Does

some of this fertilizer get converted into elements of a plant? (31)

Why is it important that we eat food (apart from feeling hungry). Will our body stop growing if we do not eat? (32)

If yes, does it imply that a part of the food that we eat gels converted into various elements of our body? (33)

Fertilizer and food are both non-living. But because of them various elements and parts of both plants and animals grow.

Reflect on the following statement :

'Living objects keep on changing into non-living objects and non-living objects help in the process of growth of living objects'.

Draw a line diagram to depict this 'living to non-living to living' cycle.

Think and answer

A railway engine

a) takes food (in the form of coal and water)

b) moves about

c) breathes in and out (because of the backward and forward movement of the piston)

d) grows in length (with the addition of coaches).

Will you call it living? Answer with reasons. (35)

In the context of living and non-living, what is the difference between a railway engine and a buffalo. (36)

APPENDIX 1 1 1

THE HOSHANGABAD SCIENCE TEACHING PROGRAMME

In this section we describe an innovative experiment in school education started in 1972 by two voluntary agencies, Kishore Bharati and Friends Rural Centre, Rasulia, with the permission and support of the Government of Madhya Pradesh, in sixteen rural middle schools in Hoshangabad District. Eklavya has now taken over the responsibility of running this programme.

The chief objective of the Hoshangabad Science Teaching Programme (HSTP) was to explore the extent to which innovative changes can be introduced within the framework of the Government school network to replace the unscientific and irrelevant educational system. The programme undertook to investigate the feasibility of the 'inquiry method' in the learning of science at the village level. In course of time/ the concept of environment-based education was also included as an integral part of science education and subjected to testing under field conditions.

HSTP has been a significant experiment in science teaching which has seen the involvement of University and College-based scientists in school education and the production of science workbooks in Hindi that have been designed in accordance with the 'inquiry approach' and hence do not merely communicate facts.

A basic assumption in this effort has been that learning by the 'inquiry method' helps in building up a questioning and analytical attitude amongst children. Combined with the programme's emphasis on learning directly from the village environment it is hoped that critical thinking thus daveloped shall constitute a significant input for building up processes of social change.

District Level Expansion : The programme was extended in 1978 from the initial sixteen middle schools to all the middle schools (about 250) of Hoshangabad district. This expansion to us is a confirmation of the belief that it is possible to implement educational innovations at macro-level, if planned and executed by combining relevant experiences with an objective understanding of existing conditions. The chief elements of such a combination are :

i) field experience in testing innovations and utilising support structures, ii) an objective assessment of the operative conditions in a Government system, and iii) a firm commitment to implement innovations.

Resource Personnel: This expansion has resulted in the training of nearly 600 school teachers with the assistance of a large number of resource personnel. The pro-

gramme has been academically guided through the active involvement of scientists, educators and research students from many institutions which include Delhi University, Tata Institute of Fundamental Research, NT's, National Physical Laboratory and various Post-Graduate Colleges of Madhya Pradesh. The Delhi University Group received support from the UGC to participate in the programme. A Post-Graduate College teacher, was deputed by the Government of Madhya Pradesh to work in HSTP on a UGC Teacher Fellowship. Those arrangements have set a precedent in recognizing the validity of the role which can be played by the University community in the improvement of school education, a factor realized and recommended by the Kothari Commission but, perhaps, never implemented before in this formal manner.

Methodology of Learning : The methodology consists of learning through experiments and analysis and not through memorized lectures delivered bya teacher. The observations and data collected are recorded by the children and later analysed with the help of the teacher. The classroom experiments are interspersed with field trips to agricultural fields, forests, rivers and the village to learn directly from the environment. The teacher's role is hence transformed from that of being an imposing fountajnhead of all knowledge to acting as a guide and helper in learning through experience and the environment.

Follow-up and Feedback : An important innovative aspect of the programme has been its system of follow-up and feedback. Training teachers without a substantial follow-up component is inadequate. Hence regular monthly follow-up meetings are organized to strengthen and continue the training process through visits by trained follow-up persons to the schools at regular intervals. A cadre of such follow-up persons, composed of Higher Secondary school teachers and Middle school Headmasters has been created and trained. This is also, perhaps, the first instance where such a recommendation contained in the Radhakrishnan Commission report has been implemented. During these follow-up visits, useful feedback on material and methodology is collected directly from the classroom.

Workbooks : It is a contention of the programme that material for scools can be prepared only through direct interaction with teachers, students and the village environment. Most material prepared from urban headquarters, irrespective of the quality of scholarship behind it, turns out to be not only impractical but also irrelevant. With this in mind, all the material prepared under HSTP has been tested in the orientation courses with teachers and further modified on the basis of feedback gathered through follow-up meetings and visits, plus a study of the local environment. Workbooks are designed to give instructions to students on performing experiments, along with a set of questions to help them analyse their obsreva-tions and data.

Examination : The traditional examination pattern is seen to be incompatible with the objective of an environment based discovery approach to the learning of science. Traditional

examinations chiefly test a student's capacity to memorise and recall facts from books or dictated notes. In contrast, HSTP emphasizes qualities of independent observation, data collection, free-thinking, logical deduction and, above all, conceptual understanding through an open book examination.

Teacher Training : The training of teachers has been conducted through orientation courses held at regular intervals. In these courses, new chapters of the workbook are introduced. Teachers perform all the necessary experiments under the guidance of resource personnel. An intense discussion follows regarding the necessary modifications needed in a chapter. The feedback is collected and the chapters are modified in accordance with the criticism of the teachers. Only then U a chapter accepted and prepared for school trials. This process of teacher interaction is sometimes repeated in different courses for the same chapter and the material is continuously modified. Through such training programmes, the active participation of the teachers has been ensured in academic matters. In addition, teachers are equipped to handle their students with added confidence and are also oriented in the philosophy of the 'inquiry method'. The entire training process has been marked by a basic respect for the teacher's ability to effectively contribute in a growing programme of this nature. This principle has helped create an atmosphere of mutual exchange of ideas information, experiences and criticism.

Bulletin : Since June 1980 a bulletin titled 'Hoshangabad Vigyan'is being brought out. Till now, nine issues have been released. This bulletin is envisaged as a communication channel between resource personnel, teachers and students. It is expected to help in creating a teacher's forum in which views can be expressed and exchanged in an open and free atmosphere.