HOSHANGABAD SCIENCE TEACHING PROGRAMME (HSTP)
STUDY REPORT (PHASE-I)
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EXECUTIVE SUMMARY

This pilot study represents Phase I of a comprehensive study of the Hoshangabad Science Teaching Programme (HSTP), an innovative science education project that ran for over 30 years in government schools in Madhya Pradesh. The state government abruptly discontinued the programme in 2002, at which time it was operative in around 800 schools, covering more than 10,000 students at the upper primary level (Class VI to Class VIII).

We hope the wider study, which takes both an empirical quantitative and ethnographic qualitative approach, will help us gain a richer understanding of HSTP and capture its impact on science education in India. Equally important is identifying the weaknesses of this innovative programme, which lead a section of parents, teachers, students and administrators to vehemently oppose it.

The pilot study covered over 300 respondents from the Harda Sangam Kendra (SGK), who participated on a voluntary basis. They included teachers who taught science under the programme during its lifetime, students who had studied HSTP at the upper primary level and were in Class X at the time the data was collected, parents of some of these students, and adults who had studied HSTP 15 to 17 years earlier and are now gainfully employed.

We conducted a series of workshops to design the tools for the study and tested these tools in an area comparable to where the data was eventually drawn from. Data collection required permissions from several quarters. The ease with which these permissions were obtained reflects the enormous goodwill towards the programme at the ground level.

It took three rounds of visits to collect the data. Elicitation techniques included responses to multiple-choice questions and short descriptive answers to questions focusing on conceptual understanding of science, interviews and experimental science tasks for teachers.

We classified the data into four categories – socio-economic background, conceptual understanding of science, attitude to HSTP and proficiency in Hindi – and subsequently coded and computerised it using the SPSS programme.

In the absence of a control sample, we are not in a position to make any definitive comment on the performance of the respondents. However, in general, the responses were better than average in the multiple-choice questions that tested for conceptual understanding of science. In the short answer questions, which also tested conceptual understanding teachers fared reasonably well, while the performance of students left a lot to be desired.

Two factors may have influenced overall performance. First, the linguistic ability and confidence levels of the respondents were fairly low. Second, several questions hinged on counter-intuitive ideas in science that constantly trouble both teachers and students in a learning process. We had asked respondents to give reasons for their answers. That apparently proved to be a bit difficult.

Teachers seemed to have fared better in the experimental science tasks assigned to them. They showed the ability to engage with new problems, conceptualise experiments, perform them and draw significant conclusions from their observations. They also showed the ability to think and work as a group, dividing responsibilities wherever necessary. But they appeared comparatively ad hoc and unsystematic in recording data and documenting the process and their approach.

An analysis of the data reveals that most teachers and students remembered HSTP's academic activities quite vividly and had a positive attitude towards it. They showed a broad understanding of its underlying principles, methodology and objectives as well as the systems for training teachers to take on a more challenging role. They constantly pointed out the positive aspects of HSTP – how science is transacted in the classroom, the changed classroom architecture, experimentation, discussions, open-ended answers that cannot be memorised, open-book examinations, and so on.

They were also aware of problems that stood in the way of implementing the programme in the field, such as lack of administrative support and appropriate enabling conditions. They clearly saw that the system lacks preparedness to implement similar pedagogical ideas across subjects and classes.

However, despite their understanding and attitude, both students and teachers don't see a role for themselves in any effort to restart the intervention.

The pilot study also revealed the complexities of designing data collection tools and undertaking an analysis of this scope and nature. But it did provide a framework for modifying and improving these tools and arriving at an appropriate design for the more detailed Phase II study.

HSTP STUDY REPORT (PHASE I)

1. Background

1.1 Introduction

The rhetoric of learning science through experiments has always been there in the history of science teaching in India. However, such ideas remained confined to the pages of reports published by successive education commissions until the latter half of the 1960s, when inquiry based approaches that had been informing school science curricula in other countries began finding their way into experimental science teaching programmes here. It marked a shift in emphasis from rote learning of scientific facts and techniques to helping children understand the structure of the discipline through experiment and discovery. But, for various reasons, these early micro-level initiatives in some elite public schools across the country and a few municipal schools in Mumbai proved to be short-lived.

Fortunately, they did provide an impetus to two NGOs in Madhya Pradesh, Friends Rural Centre (Rasulia) and Kishore Bharati (Palia Pipariya), to introduce similar ideas to science teaching in rural schools. The NGOs saw the effort not just as an exercise in academic improvement but as an important input for socio-economic transformation of rural India. They believed that 'good and effective training during the early years in the method of science would help children develop their inherent analytical powers, their ability to formulate and observe problems, make logical analyses and draw conclusions from theirexperiments.

The NGOs were, however, aware of their limitations in terms of professional competence to address the academic needs of such a pioneering effort. Hence, they created a platform where teachers from rural schools and academicians and scientists from institutions of higher learning and research could collaborate to develop the innovation.

This group formulated a pilot project of discovery based science teaching for students at the upper primary level (Class VI to VIII), which later came to be known as the Hoshangabad Science Teaching Programme (HSTP). The project was initially implemented in 16 schools in 1972 and later scaled up to 250 schools in Hoshangabad district in 1978. In 1982, a new organisation called Eklavya was set up to consolidate, strengthen, and expand the HSTP. Eklavya, which had a wider mandate of developing similar innovations in other subject areas, seeded HSTP in 13 other districts of the state.

On July 3, 2002, the Government of Madhya Pradesh shut down the HSTP without assigning any reason for its abrupt decision. No attempt was made to first review the programme to assess its strengths and weaknesses before deciding on its future. The closure evoked widespread reactions from the academic and scientific community.

At the time of its closure, around 10,000 students in over 800 schools in 15 districts of Madhya Pradesh were learning science the HSTP way. Over 3,000 teachers had undergone a series of trainings of unprecedented rigour and depth during the lifetime of the programme. Many hundreds of resource persons from across the country had also been oriented into its methodology and objectives, thus enabling HSTP to serve as a blueprint for seeding innovative interventions in science education in many other states.

1.2 Basic principles of HSTP

The HSTP sought to structure the learning of science around the principles of 'learning by discovery', 'learning through activity' and 'learning from the environment', in contrast to the prevailing textbook-centred 'learning by rote'. It sought to bring experiment and observation to the centre-stage of learning science at the upper primary level of schooling (Class VI to VIII). An inexpensive, easy-to-handle kit was developed for the purpose, with many of its items being locally available.

Basically, students were given instructions to conduct experiments in the classroom and go out on field trips when required. They were expected to work cooperatively in groups, making detailed notes and tables of their observations and the data generated by the experiments. They then had to share and discuss their findings with their classmates, the analytical process being helped along by a series of leading questions posed in the workbook. An understanding of the scientific concepts underlying the problem being investigated was supposed to emerge from the discussions. Since no rules, laws or formulae were given in the workbooks, the students essentially 'discovered' these scientific principles, with the teacher guiding them through the discovery process.

Learning usually began with the students' own experiences and understanding of everyday phenomena occurring in their environment. Their commonsensical explanations are often at variance with known scientific facts, which in many instances can be counter-intuitive. But misconceptions were never treated as untruths. Rather, they served as starting points for investigations.

The HSTP, thus, saw students as active learners, engaging with knowledge,, not as empty receptacles to be filled or clay to be moulded into pre-determined shapes. Students were not expected to learn things by heart or assimilate a body of given knowledge. Rather, the idea was to make learning an interesting and meaningful activity, not an imposed burden.

The emphasis was on developing the creative and critical faculties of the students. They were encouraged to ask questions about things they did not understand and become more aware and curious. They were also expected to develop their observational skills and their ability to use their hands so they could perform experiments and logically analyse what they saw and did to arrive at answers to the problems they took up for investigation.

End of the year examinations were modified, in keeping with the requirements of the new methodology. They did not test for rote learning or information content, but for analytical ability, reasoning, conceptual understanding and experimental skills. They included both practical and theoretical components. To make them less intimidating, paper setting was de centralized, with the school teachers themselves setting the papers. Students were allowed to refer to their notes and class records to write the answers.

In a learning process of this nature, students require space to investigate, discuss and be active. This is where HSTP differed from conventional teaching methods in which disinterested students listen to lectures given by teachers. The programme rejected a discipline imposed through fear and coercion. It saw teachers and students as participants in a learning process that emphasised dialogue and discussion.

This put an additional burden on the teachers, who had to be prepared to admit that they may not know the answers to all the questions asked, but should also have the wherewithal

to suggest how the students could go about looking for answers. That was asking a lot of them, especially because teachers in Indian schools are usually the most neglected link in the educational chain, without any support systems.

One of the cornerstones of the HSTP, therefore, was to break their almost total isolation and empower them. Systems were devised for their continual in-service training and for supporting them in the classroom. The HSTP also involved them in all aspects of curriculum development, from textbook writing to assessment of student performance to conducting training programmes. They collaborated with university faculty to design course materials including experiments.

One other important aspect of the innovation was its focus on administrative reform. Those who conceptualised the programme knew the intervention would be meaningful only if it worked in ordinary government schools. They did have their reservations about its implementation, given the prevailing infrastructural and administrative conditions. So they tried to set up specialised administrative systems that could respond quickly to situational problems and speed up the government's slow decision-making process. The key was to decentralise and democratise the systems, giving more authority to people working in the field to take decisions.

- To decentralise this back-up system, schools were grouped into complexes at the block level, with a local higher secondary school serving as the Sangam Kendra (meeting place).
- The teaching-learning materials were constantly revised and upgraded on the basis of field experiences and the feedback gained from students, teachers, parents and resource persons.
- The new administrative structures set-up at different levels included a Sanchalan Samiti at the state level; a Science Unit at the division and district level office for administrative and academic work; School Complexes at the block level to coordinate different aspects of the programme; and an Operational Group (high school teachers) at the block and cluster levels to follow-up and support the teachers and programme in different ways.

1.3 HSTP: A landmark in school education

The HSTP proved to be a landmark in the history of school education in India. Academicians and scientists saw it as a path-breaking initiative of global significance.

The HSTP was the first sustained civil society effort to remould science education in line with universally accepted educational objectives. It showed that it is possible to take a more democratic and plural approach to curriculum development rather than centralising this function within a single government body. It also showed that it is possible to introduce the discovery approach to learning science in resource-poor schools. Most importantly, it provided researchers and teachers an opportunity to collaborate in an innovative programme for under-privileged students.

In academic terms, students found themselves liberated from the confines of the textbook and classroom in their quest for knowledge. Teachers felt empowered as they became more active in all aspects of science teaching and school education.

The HSTP created democratic, grass-root level structures to administer the programme, collect feedback from schools and provide on-site support to teachers. It published magazines like *Chakmak*, *Sandharbh*, *Srote* and *Hoshangabad Vigyan* to provide out-of-school support to students and foster their interest in science. It also created institutions like *Sawaliram*, a forum that assures students of scientifically sound answers to any question they may pose and provides them the space to share their experiences, hopes and concerns.

The HSTP became a paradigm for other Eklavya programmes such as the Primary Education Programme (Prashika) and the Social Science Teaching Programme (SSTP). It also served as a blueprint for several other states and institutions to start their own science education programmes.

1.4 Why the present study?

The closure of the HSTP was a major shock not just for the community of teachers and students but for those seeking changes in the way science is taught in Indian schools. Since there appeared to be little scope of restarting the programme, the immediate need was to document and preserve its learnings for future reference and examine its impact on science education in the country. The passage of time since the closure lent urgency to the task.

The present study, undertaken in collaboration with Eklavya, is a consequence of this concern. It seeks to capture the spirit of the HSTP and its influence on teachers and students, both past and present. The idea was to see whether the changes in thinking and attitudes as well as in teaching-learning practices envisaged by its initiators had actually taken place, to what extent they had been effected, and if not, why not. Had the HSTP influenced the classroom strategies of teachers and their conceptual understanding of science? Had it induced changes in the learning styles of students and their outlook to life?

This involved studying the personal backgrounds and language proficiency levels of the teachers and students and matching these with their attitudes to the HSTP, traditional science teaching and other subjects. Given the 30-year lifetime of the programme, there would be thousands of such students, many pursuing successful careers and some as old as 40 years.

Eventually, data was collected from four sets of respondents in one SGK of Harda district - teachers who had taught science under the HSTP, students who had completed the HSTP up to Class VIII and were in Class X at the time of data collection (termed ‘current students’ in this report), parents of some of these students, and those who had studied HSTP science 15 to 17 years back and are currently working (termed ‘former students’ in this report).

The preliminary analysis of this data, contained in this report, represents Phase I of our study. The tools for data collection and analysis were also developed and tested during this phase. The next step is to design a comprehensive controlled study (Phase II) that would make a comparative assessment of samples of both HSTP and non-HSTP students. The tools tested during Phase I will also be further developed.

2. Preparing for the study

2.1 Introduction

The HSTP sought to reform science teaching in schools by changing pedagogical practices, modifying classroom interactions and revamping the way student performance is evaluated. Appropriate workbooks were developed and mechanisms for teacher training, academic support, student evaluation, administration, and distribution of kit materials were put in place.

Over 3,000 teachers were trained during the 30-year lifespan of the HSTP, undergoing 55-odd days of intensive training spread over three years for Class VI, VII and VIII. Of these, around 300 became trainers and contributors to the development, implementation and consolidation of the programme.

Capturing the impact of this intervention on teachers and students in particular, and on all aspects of school education in general, was a mammoth task. Trying to do it two years after the closure only made it doubly difficult.

It wasn't as if similar studies had not been carried out during the HSTP's lifetime. Because of its pioneering nature, the innovation was often the focus of doctoral dissertations of students from universities across the country. However, these studies were usually limited both in terms of their scope and sample sizes. They also tended to suffer from lack of rigour because of inadequate professional expertise.

Equally unfortunate was the fact that no in-house studies had been undertaken to track the evolution of the HSTP and document its different aspects while it was in operation, although the HSTP group was well aware of the need for such long-term monitoring. It just could not spare the resources for the task because all its energies were focused on implementing the programme in the field. Some ad hoc research studies were taken up but these were limited to concept testing and classroom observations to aid in the revision and modification of course materials. Wherever corrective action was needed, the group depended on the feedback collection mechanisms that had been put in place.

Even the review of the HSTP conducted by an NCERT committee in 1991 to assess the feasibility of expanding the programme over the entire state of Madhya Pradesh did not go into any detail about the pedagogical aspects.

2.2 Outcomes of the initial discussions

.Firstly, we felt that a preliminary analysis would give us a broad understanding of various aspects of the programme, which could then form the basis for the comprehensive study. This larger study would include a control group from a non-HSTP area, enabling us to make comparative assessments and come out with some definitive statements and conclusions about the HSTP intervention.

Secondly, we needed to identify the tools for data collection and develop and test these tools. A pilot study would be ideal for the purpose.

We also decided to postpone any comparative analyses with other innovative programmes to a later date.

2.3 Including components for the final study

This changed the nature of the study. Take, for example, the issue of data collection. We initially thought of picking a sample of HSTP students currently studying in Class VIII (at the time of data collection) and comparing them with a similar set of non-HSTP students. However, we gave up the idea because we felt a one-year experience of the HSTP (of Class VI only, since the students had reverted to traditional science teaching in the two years after the closure) would be inadequate for the more intensive evaluation we were thinking of taking up later. So we decided to collect data from students who had gone through a complete cycle of the HSTP (Class VI to VII) and were studying in Class X at the time.

We also kept the larger study in mind when listing out the characteristics and attitudinal changes the HSTP was supposed to develop in students and teachers. To get as clear a picture as possible of whether such capabilities had actually been developed, we decided to include the following three components in the final study:

- A study of former HSTP students now in the 25-35 years age group. We felt it may be a good idea to include those who had done exceptionally well in life and record their reflections on the HSTP, their teachers and their school experiences. We could ask teachers to help identify such students from Sawaliram letters and from the registers of 'good' schools.
- A study of current students who had gone through three years of HSTP science, to elicit their attitudes to different aspects of science and science education. This would include their attitude to learning, experimentation and analysis as well as their articulation and self-learning abilities. Since there could be other socially positive attributes that the HSTP may have helped develop, we decided to draw up a list of such attributes.

  While we were concerned about making the student sample as bias free as possible, we felt it may not be necessary to pick their names completely randomly from the total sample. Rather, we could take stratified samples and even look only at good schools or schools that had seriously implemented the HSTP. What was important was to ensure that those who collected the data understood the reasons behind the sampling choice and how they should record and analyse the data.

- A study of the best HSTP schools, teachers and students. We would have to identify the best schools and teachers and, through them, the best students to collect their impressions of various school issues.

In addition, we felt the final study should examine, in some detail, the responses of the general public in Madhya Pradesh to the HSTP.

2.3 Areas of study

Given the urgency of the task, we felt the best way to design the study and tools would be in a workshop mode. We could then circulate the draft design to a wider selection of experts to get their feedback and comments before finalising it. An orientation workshop could then be held to prepare the study team for the task.

The following areas were short-listed for the study:

1 Achievement of HSTP objectives.

2 The HSTP methodology.

- Academic:

  - HSTP's understanding of science.

  - Training, teaching materials, classroom processes, kit, follow-up, evaluation.

- Administrative and functional aspects, including NGO-government partnership and funding sources.

3 Perceptions of students, parents and teachers

4 Social implications

2.4 Respondent populations

The following respondents were identified from whom we could collect data of various kinds:

Current HSTP students, teachers, retired teachers, resource persons, government functionaries, local teachers, former HSTP students, members of the local community and the general public.

2.5 Tools and data collection

Given the scope of the study we needed both quantitative and qualitative data, covering details of the personal background and socio-economic status (SES) of the respondents, their proficiency in Hindi, their conceptual clarity of science, their attitudes to the HSTP and its different components, and so on. Extracting this information would require close interactions with the respondents and considerable probing and questioning. That meant we needed an array of tools that would include different sets of questionnaires, structured interviews, focused group discussions (FGDs) and experimental science tasks.

Equally critical was the problem of how to administer and analyse these tools. We opted for an iterative process, first referring the tools to a wide set of people to get their opinions and then conducting a pre-pilot on a few students and teachers in the Narwar SGK (Ujjain district) as well as students from Udaipur to see how they interpreted the questions. The set of tools was finalised for use and further testing in Phase I on the basis of the feedback we got.

Filling out questionnaires is a tedious and time-consuming affair so we knew we would have to make special efforts to motivate teachers and students to take the exercise seriously. Initially, we even thought of turning the process into a kind of competition for which prizes would be awarded. But we dropped the idea.

Regarding the group discussions, we would provide an opportunity to get a deeper understanding of teachers' opinions and attitudes to the HSTP as well as their conceptual understanding of science. Bringing them together in a group would encourage them to talk freely and openly, something they may not do in a more public forum. We thought of conducting FGDs with 25 randomly picked teachers who had undergone training and had taught HSTP science and with 15 core resource teachers in each of the SGKs we chose for data collection.

We eventually formulated the following plan to collect data from the different sets of respondents:

- Get all HSTP teachers of the SGK to come to a specified place for a day.
- Get 25 teachers to stay at the SGK for a day.
- Spend two days collecting data from 2-3 high schools.
- Spend three days collecting data from parents and former HSTP students.

The next step was to allocate responsibilities for the tasks to be carried out among the study team members. Since data collection would require more people, we made a call for volunteers familiar with the HSTP to join our team.

2.6 Sample choice discussion

The areas in which the HSTP was operative can be divided into two categories: the area in which an entire district was covered and the area in which a few schools of a block were covered. In Hoshangabad district, the HSTP had been running in all the schools of the district from 1978. After its bifurcation in 1998, Harda became the second district wholly covered by the programme, without any non-HSTP schools. In the other 13 districts, the HSTP was implemented in select school complexes from 1983.

We needed representative samples from both these areas. The initial plan was to randomly pick two SGKs from Hoshangabad/Harda districts and two SGKs from the other districts and collect data from all the schools in these samples. However, during the discussions we felt we needed to make a further distinction between urban and rural SGKs. That was not an easy task so we decided to go by the administrative definition of rural and urban blocks in picking rural and urban SGKs from our sample areas. That would give us two SGKs covering all the schools in a block in the district category and two SGKs covering the senior secondary school and its 8-9 feeder schools in the school complex category. Half the selected SGKs would be urban and half rural.

2.7 Sources of data

2.7.1 Secondary data from deskwork

The study would require a lot of deskwork of two kinds. The first related to the history and growth of the HSTP and statistical data covering the total number of schools and students under the programme, teachers trained, resource group and other aspects. Much of this documentation was available with Eklavya.

The other kind of material, available at the SGKs, included reports of monthly meetings and follow-up, examination results and so on. It also included statistical details of the SGK covering:

1. Number of schools, name, location, student population.
2. Teachers trained under the HSTP (three-year training)
3. Resource group teachers.

The data would help us prepare a written history of the HSTP, tracing its evolution and growth, including the use of supplementary reading materials like *Hoshangabad Vigyan*,

Srote, *Chakmak* and *Sandharbh*, by addressing questions like: Why HSTP? How did it grow and change? How did it survive? Why couldn't the system sustain it?

2.7.2 Primary sources of data

As stated earlier, we planned to collect data from the sample areas through questionnaires, interviews, FGDs and experimental science tasks. These are discussed in more detail below:

Questionnaires: The idea was to prepare a series of questionnaires to elicit different kinds of data, including background information of the respondents, their attitudes to the HSTP, conceptual understanding of science, language proficiency and so on. Some would be common for all respondents, while others – for example, to test conceptual understanding of science - would require separate sets of questions for the different sample categories. We initially thought of designing questionnaires for HSTP resource persons and the general public as well but dropped the idea for Phase I because we felt we should first understand how these things are done. So we restricted ourselves to the following set of questionnaires:

1. Personal data sheet.
2. Studying conceptual understanding of science through:
    - 20 to 30 multiple choice questions.
    - 5 to 8 short answer type questions on a 5-point scale.
3. Studying attitudes to the HSTP on different agreement scales
4. Studying other skills like:
    - Reading proficiency.
    - Problem solving.
    - Approach to common phenomena.

We felt we could administer up to four questionnaires a day, which meant we needed around two days for a complete set.

Interviews: We envisaged a Vidya Bhawan team, assisted by independent researchers, conducting in-depth interviews with teachers selected randomly from the SGKs. The interviews would be tape recorded for further analysis and would, by and large, focus on teacher trainings in terms of**:**

- Teacher participation in the HSTP.
- Difference between the HSTP and other trainings.
- Nature of resource persons and quality of interaction with them.
- Peer group interaction, scope for raising questions, discussions.
- Textbooks and teaching methods.
- Classroom processes, nature of experiments and transactions.
- Attitude to open-endedness, student participation, etc.
- Follow up and feedback systems, including school visits and monthly meetings.

- Kit requirements and maintenance.
- Supplementary reading materials and library (during and after training).

In addition, we thought of conducting interviews covering similar issues with parents and other members of the community, including local leaders, former HSTP students and some current HSTP students.

Focused group discussions (FGDs): The focus in the FGDs would be on studying the attitudes of respondents to all aspects of the HSTP, including its guiding principles and implementation. We thought of organising such discussions with teachers - including the older HSTP teachers, newer teachers and resource teachers - at the block level. The main concern was to structure these discussions in a way that teachers would respond with sincerity and clarity.

We felt we could conduct similar discussions with a group of HSTP students.

Experimental science tasks: This exercise would be carried out with groups of 15 to 20 teachers to assess their conceptual understanding of science and their ability to handle scientific equipment. Each teacher would choose an experiment from a basket of tasks, follow instructions to perform the experiment, after which he/she would explain the procedure adopted, the results obtained and so on. A group discussion would follow in which teachers would make a presentation of their work.

2.8 Possible focus areas

The areas for study were identified during the tool formulation workshop. For teachers, the focus would be on the following:

Attitudes	Understanding of science and the HSTP
Attitude to science.	Understanding of concepts.
Attitude to children.	Understanding of controls.
Attitude to learning.	Understanding of classroom processes.
Attitude to experiments.	Understanding of students' answers.
Attitude to relevance of education.	Skill and capability in performing experiments and visualising experiments and kits.

We also wanted to find out what teachers thought about the HSTP closure in terms of changes in the science classroom and school; how it affected them individually; how it affected their students; and their clarity about the change.

For the HSTP, we felt it would be useful to focus on the following features:

- Making science activity based.
- Inculcating the ability to:

- think, ask questions, be creative and curious.
- perform experiments.
- gather/record data, make pictures, represent data.
- analyse and infer.
- design new experiments.
- understand least count and errors in measurement.
- read graphs, circuits, schematic diagrams.

- Problem solving in a scientific way:
  - following instructions to do a task.
  - approach to commonplace, everyday phenomena.
  - ability to face new situations (requiring thinking).
- Designing question papers, open-ended questions and responding to such questions.
- Attitudes to:
  - science.
  - learning.
  - dialogue and discussion.
  - open-book examinations.
  - open-ended questions/knowledge.

It was clear that several other aspects would emerge during the course of the pilot study. These aspects would have to be detailed out so they can be taken up for examination in the wider study. The possible framework for this comprehensive study that emerged from the discussions outlined in this chapter is summarised in the following table:

Framework for a comprehensive study

	Areas of study	**Sample selection and study process**	**Comparison areas**	**Method and process**
1.	Achievements - of students - cognitive spread - effect of intervention on teachers - is there better conceptual understanding? (M*ore elaborate list to be prepared*)	• Current HSTP students • HSTP teachers - in service - retired • Former HSTP students • HSTP resource persons. • Govt. functionaries who administered HSTP • Local leaders and wider community	**A.** Primary sample 1. Hoshangabad district (One rural and one urban SGK) 2. Non-HSTP area outside Hoshangabad. (One rural and one urban SGK) **B.** Comparative sample Narsinghpur/Betul (Two SGKs)	• Demographic detailing • Pre-pilot • Tools preparation • Pilot study in one SGK • Sample selection in school complexes and SGKs through demographic and other details.

2.	Uniqueness of HSTP Methodology/materials (impressions of people) - Training - Classroom process - classroom architecture - teacher-student relationship - peer-learning - participation of students in class. - Textbooks/teachers guides - Kit - Follow-up - Knowledge relations - Knowledge notion	- Desk work - Documentation study - Interviews with different people		
3.	Social implications and input	- Interviews		
4.	Perception of parents, students, teachers about science education and other inputs of Eklavya (Sawaliram, *Chakmak*, etc)	- Interviews and attitudinal questionnaires	2. Two school complexes in the district from where HSTP schools are chosen outside Hoshangabad. (Parameters to be spelt out.)	
5	a) Decentralisation/ management of education b) Academic interaction and providing resources.	- Interviews		
6	a) Has the HSTP group evolved in 25 years? In what way? What is its understanding of science? b) NGO-Govt. partnership – its efficacy c) Funding sources	- Documents - Interviews		

Many areas listed in the table require more time for study. The methodology may also be slightly more complicated and require further detailing. We felt that even in the wider study it may be possible to only look into areas 1, 2 and 4. It's not as if the remaining areas were not important but we felt we were not in a position to consider them in our study design.

Given the volume of data to be collected and the resources required, we decided to restrict ourselves to recording and describing the existing situation in one SGK in Phase I, without going in for a comparative assessment. However, the format for data collection would dovetail into the larger study. We felt we could get a broad picture of what exactly the

HSTP meant to the respondents, which would help us understand how we should go about undertaking a more detailed analysis.

2.9 Conclusion

The discussions showed that we could conduct the entire study in three phases, the present effort being Phase I. We shall develop proposals for the subsequent phases and seek financial support from different sources. The study design discussed here is of the wider study, which would include comparative data of a control sample from districts adjoining Hoshangabad. One worrying factor is the time lag. The HSTP experience is passing into memory, attenuating impressions of the programme among respondents. So one of the questions we asked ourselves was whether we should collect data from more SGKs and school complexes in Phase I itself, before we lose access to the respondents with the passage of time.

To summarise, we expected the following outcomes from Phase I:

- Design of the comprehensive study.
- Objectives of the comprehensive study.
- Preparation of tools for the pilot study.
- Recording the experiences of one SGK.

3. Methodology

3.1 Introduction

As pointed out in Chapter 2, a comprehensive study would require more time and financial resources to investigate several aspects of the HSTP. The primary purpose of Phase I was to develop and field test the required tools and record the experiences and understanding of the HSTP among current and former students and teachers in one SGK. Comparisons with a non-HSTP control sample would be taken up in the final study.

3.2 Sample for Phase I

We first drew up a list of SGKs in Hoshangabad district. Initially, we thought of choosing the Itarsi SGK because, historically, the HSTP faced the greatest opposition here. Also, Itarsi is accessible and provides a combination of urban and rural sectors. However, we decided to leave this SGK for the final study and picked another SGK at random from our list. The choice fell on Harda, which also has a sufficient number of rural and urban schools.

Of the different categories of respondents identified, our focus would be on teachers and students, since they were the major players as far as HSTP classroom interactions were concerned.

3.2.1 Teacher sample

We prepared a list of teachers in the Harda SGK who had undergone three years of training under Eklavya for Class VI, VII and VIII. We randomly selected 100 names from this list of 270 teachers. We deliberately chose a large sample because we had been forewarned that many teachers may have retired, been transferred to other schools or shifted their residence. We also needed a cushion for absentee teachers on the day we collected the data. For example, a 30-35 teacher sample on a Sunday would require sending out many more invitations.

We were also advised to compensate teachers for their time and effort. However, there was opposition to this idea, given the long-standing tradition of voluntary association of teachers with Eklavya. So we decided not to offer any compensation.

We sent a written invitation to 100 teachers on behalf of Eklavya and Vidya Bhawan, requesting them to participate in the effort. No compensation was offered and no official order was attached. Only 17 teachers responded. So we sent a second invitation, this time routed through the District Education Officer (DEO). A further 18 teachers responded, giving us a total of 35 teachers for data collection. Of these 35 teachers, 14 were randomly chosen for the intensive interviews.

3.2.2 Student sample

We chose two student samples for study: students currently in Class X in secondary schools and former students in the age group of 25-35 years. We felt the first set would provide us insights into how the HSTP had impacted their lives while the second set would provide data useful for future comparisons with control samples of students from non-HSTP areas.

Selecting an unbiased sample means ensuring that all types of secondary schools are represented. The range includes rural and urban, private and government, English medium, co-educational and boys/girls only schools. The Harda SGK has 12 high schools and higher secondary schools, nine urban and three rural. The urban schools cover the entire range of schools while the rural schools are of a single type - government co-ed schools.

We picked one school each from the following categories by drawing lots:

- Urban government boys' school.
- Urban government girls' school.
- Urban government co-ed school.
- Urban private (English medium) school.
- Rural government co-ed school.

This sample of five schools included a School of Excellence (*Utkrasht Vidyalaya*), where talented students selected from the district are admitted.

Current students: We randomly chose one section each of Class X of the five selected schools for our sample of current students. These students were the last batch to have studied all three classes (VI, VII and VIII) under the HSTP, after which the programme was discontinued. Some of the selected schools had only one section while others had more than one. We randomly chose one section each from the latter lot, giving us a total of 259 students from five sections.

Former students: We prepared a list of students who appeared for the Class VIII Board examinations from the five selected schools (including their feeder schools) in the three academic sessions 1987-88, 1988-89 and 1989-90. These years were chosen because we wanted adults in the 25-35 years age group who had gone through three years of HSTP (Class VI, VII and VIII) and were now well-settled in life. The list had 248 names from which we randomly picked 100 names from Harda (urban) and Handia (rural area of the district). When we tried contacting these former students, we ran into the following problems:

- Some addresses were not available with the schools.
- Some students were not available at the given/old address and no new address could be found.
- Some students had left Harda to take up jobs in places like Bhopal, Ahmedabad, Mumbai, Delhi, etc and could not be contacted.

Since the number of former female students available for data collection was insufficient, we were forced to ask the available students for names of other former female students from the area who belonged to the same batches. We finally got a total of 48 former students to participate in the exercise.

3.2.3 Parents sample

To select the sample of parents, we divided the five sample schools into two categories - urban and rural schools. We randomly selected the names of 10 students from one sample set of 205 children belonging to four urban schools, using a lottery system. Similarly, we randomly selected three names from the second sample set of 54 children belonging to one

rural school (Handia). We thus got the names of 13 students whose parents formed the parents sample set. However, only 10 of them could be interviewed.

Thus, the total sample for data collection was as follows:

Table 3 (a): Total sample

1.	Current students	250 (some students in the total of 259 students listed could not be contacted for data collection)
2.	Former students	48
3.	Teachers (including intensive interview)	35 (14)
4.	Parents	10
Total respondents		**343**

3.3 Study tools

Our study tools targeted four kinds of information/proficiency levels:

- Information about the respondent (personal background, socio-economic status, etc.)
- Hindi language proficiency.
- Conceptual understanding of science, with a focus on concepts taught in the HSTP (quantitative and qualitative achievement test for teachers and students).
- Attitude/opinion of the respondent towards various aspects of the HSTP and science teaching-learning.

Given the four categories of respondents – current students, former students, teachers and parents - we knew we would require separate tools for each category, although there could be a lot of overlap. The following tools were designed for the purpose:

- Questionnaires (descriptive, multiple choice, 4 or 5-point agreement scales).
- Cloze test to assess language proficiency.
- Group work (experimental science task, in which a group of 4-5 teachers would pick a chit from a basket, then design and perform the experiment mentioned in it).
- Interview (general written interview schedule for teachers and intensive verbal interview checklists for teachers and parents).

Details of the tools are provided in the tables below:

Table 3 (b): Details of tools used in the study

Information/Test aspect	**Type of tool**		**Category of respondents**
	Main type	**Sub type**	

I. Personal information	Socio-economic and educational status	Questionnaire	Descriptive	Teachers, current students, former students
	Language proficiency	Cloze test		Teachers, current students
II. Quantitative achievement (conceptual understanding of science)		Questionnaire	Descriptive (short answer)	Teachers, current students
			Multiple choice	Teachers, current students, former students
	Ability and skill to do experiments	Experimental science task (group work)		Teachers (in groups)
III. Qualitative achievement (understanding of HSTP principles and attitude to/ opinion about HSTP aspects		Questionnaire	Descriptive	Teachers, current students, former students
			Multiple choice	
			4 and 5-point agreement scales	
			General interview (written schedule)	Teachers
		Interview	Verbal (tape recorded, intensive)	Few teachers
			Verbal (tape recorded)	Former students and parents

FGDs were also considered for teachers (old and recent), resource persons and students, to study their attitudes towards various aspects of the HSTP, its principles and its implementation. Eventually, we did not include these discussions in Phase I because we felt the issues that needed to be discussed in depth would emerge during this phase.

The tools are given in Annexure MI. The following tables provide a brief overview:

Table 3 (c): Tools for teachers

No	Type of tool	Tested aspect	S.No	Tool No.	Description	No. of questions
I	Questionnaire	Personal information (socio-economic and educational status)	1	T-1	Descriptive	17
		Attitude to HSTP, qualitative understanding of HSTP aspects	2	T-2	Descriptive (short answers)	13
			3	T-3	Comprehension (conservation)	6
			4	T-4	Psychometric measurement of attitude to HSTP (5-point scale)	10
					Multiple choice	6
			5	T-22	General interview (written schedule)	28
		Conceptual understanding of science	6	T-5	Descriptive (short answer)	17
			7	T-7	Multiple choice	19
II	Cloze test	Language proficiency	8	T-6	Cloze test	20 blanks
III	Experimental science task	Conceptual understanding, skill and ability to do experiment	9	T-24	Group work, experiment	One task for a group of 15-20 teachers
IV	Interview (intensive)	Qualitative understanding of HSTP principles, attitude to HSTP aspects	10	T-23	Verbal interview of a few teachers (tape recorded)	15-point checklist

Table 3 (d): Tools for current students

	Type of tool	Tested aspect	S.No	Tool No.	Description	No. of questions
I	Questionnaire	Personal information (socio-economic status)	1	T-8	Descriptive	17
		Attitude to/opinion about HSTP aspects	2	T-11	Descriptive (short answers)	12
			3	T-12	5-point scale	10
			4	T-13	4-point scale	6
					Multiple choice	4
		Relationship with other subjects	5	T-14	5-point scale	22
					Multiple choice	12
		Conceptual understanding of science (quantitative achievement)	6	T-9	Short answers	15
			7	T-10	Multiple choice	19
II	Cloze test	Language proficiency	8	T-15	Cloze test	20 blanks

Table 3 (e): Tools for former students

Type of tool	Tested aspect	S.No	Tool No.	Description	No. of questions
Questionnaire	Personal information (socio-economic status)	1	T-16	Descriptive	16
	Attitude to HSTP aspects	2	T-17	Descriptive (short answers)	7
		3	T-20	5-point scale	10
		4	T-21	5-point scale	8
				Multiple choice	6
	Relationship with other subjects	5	T-18	Multiple choice	10

	Conceptual understanding of science	6	T-19	Multiple choice	10

Table 3 (f): Tools for parents

Type of tools	Tested aspect	S.No	Tool No.	Description	No. of questions
Interview	Attitude to HSTP aspects	1	T-23	Verbal	6
					15

3.6 Descriptions and coding of tools

Table 3 (g) provides a detailed description of the tools used in the study and how different items in these tools were codified.

Table 3 (g): Description and codification of tools

S. No	Tool No	Aspects	Description and coding
FOR HSTP TEACHERS			
1	T-1	Socio-economic status	This tool included personal information about the teacher, his/her spouse, income and other details. Of the 14 variables in the data sheet, four - educational qualifications of teacher and spouse, profession of spouse and total family income - were used to determine the socio-economic index of the teachers.
2	T-2	Attitude to HSTP: Short answers	This tool had 13 questions to elicit the opinion of respondents to different aspects of HSTP. These included experiences of teaching in the classroom, teachers' training, textbooks and open-book examinations. The teachers had to respond to open-ended questions. The attempt was to find out what they felt about giving freedom to students to ask questions and whether they were expected to know all the answers. They were also asked questions about specific features like field trips, open-ended examinations and their notion of discipline. The answers were graded according to the nature of responses and their relationship to HSTP principles. They were also graded on the richness of experiences shared and the details of examples given. Seven questions was graded on a 4-point scale, with the better responses graded higher. The highest grade was 3 and the lowest 0. The other six

			questions were graded on a 3-point scale with 0 as the lowest and 2 as the highest. The maximum score possible was 33.
3	T-3	Reading comprehension	This tool, based on a paragraph about children acquiring conservation of number and volume, sought to test the ability of teachers to read and understand material related to their profession. The questions at the end of the passage were descriptive and some were open-ended. At least one sought to extend what they had read, relate it to their other experiences, and bring out new examples of the phenomena. The weightage of questions was related to their difficulty level. For example, Question 4, which was directly related to the passage and required only a mention of the age, was weighted the least. On the other hand, Questions 1, 2, 3 and 6 were given higher weightage.
4	T-4	Attitude to HSTP: 5-point scale	This tool sought to obtain a psychometric measurement of teachers' attitudes to HSTP. It was largely a multiple choice 5-point agreement scale questionnaire. Apart from the 10 questions on a 5-point scale, there were 6 other questions in the same direction, but multiple choice. The reason for making them in this form was our inability to convert them into meaningful psychometric items. Each was graded from 1 to 5, based on the closeness of the response to HSTP principles. Their formulation was such that half went from positive to negative and the rest from negative to positive, implying there was no random marking possible. The six remaining questions were graded in similar ways, except for Question 15 which had two parts and, hence, a total weightage of 10 marks. The total score was, therefore, 85. In Questions 11, 12, 14 and 16, out of four options the one closest to HSTP principles was marked 5 and next best was 3. In Question 13 the next best was marked 4
5	T-5	Conceptual understanding of science: Short answers	This tool was meant to test conceptual understanding of science of the teachers. The questionnaire was developed keeping in mind the high quality of inputs provided to them and the emphasis on conceptual clarity. It had 15 questions relating to understanding of science concepts. They were different from those that had been used earlier with teachers or students in other contexts. They covered a wide area of the Class VI, VII and VIII concepts and were extended to beyond what was expected in these classes. The last two questions tested the ability of teachers to articulate

			their notion of science and the importance of controls in science experiments. The weightage for each question was decided on the basis of its difficulty level and its centrality to concept formation in science. Some of the concepts covered included circuitry of cells and bulbs, pictorial depiction of fractions, understanding and using graphs, concept of sets, Archimedes principle, errors in measurement, meaning of area, reading and inferring from tables, heat, respiration, volume, density, area, etc. The emphasis was on asking respondents to reason and articulate their reasons. There were three questions where teachers had to suggest new experiments and six others where they had to analyse and give justifications.
6	T-6	Language proficiency Cloze test	A paragraph from a simple Hindi book on Ramanujan was selected. Using a standard Cloze procedure, every seventh word was deleted, creating 20 blanks. The first and last sentences were left intact. In assessing the responses only exact insertions were counted. No acceptable responses were considered for scoring.
7	T-7	Conceptual understanding of science: Multiple choice	The tool had 19 questions, with four possible answers for each. The respondents were supposed to choose one of the four. The questions were designed to test conceptual understanding and had many closely matching answers based on commonsensical but erroneous scientific notions. For example, the first question was on spontaneous regeneration of frogs. The third was on the string of possible tosses of a coin. The ninth was on a graphical description of the motion of a boy in a circle. There were other questions related to specific concepts from Class VI, VII and VIII, designed in a manner where the answers could be given only if the respondent had performed or got the experiments performed and reasoned out the answers. Each question was allotted 2 marks and markings were from 0 to 2.
8	T-22	Interview of teachers: Written schedule	The purpose of this tool was to give teachers the opportunity to express their feelings about HSTP and reflect on their understanding of some key issues and beliefs about the programme. The questions were related to problems they faced in teaching science, the academic support they got, whether children asked questions in the classroom, and the most effective way of teaching science. Teachers were also asked what a good science textbook is and what a good classroom is. Other questions were about open-book examinations, the

			emphasis on field visits, etc. The data was analysed qualitatively to get an overall picture of the responses. These written questionnaires were considered in conjunction with the verbal interviews with the same teachers. The transcriptions of the interview and the forms that had been filled were consolidated into what is the basis of our new study.
9	T-23	Verbal interviews of teachers	The purpose was to conduct intensive interviews with some randomly selected teachers to get more in-depth information of their views. Two persons would normally visit the teachers and record the interview with their permission. Woven around a set of questions related to HSTP, the interviews were broadly similar to those in T-22. However, based on the answers given, the teachers were asked further questions to clarify and explore their views. That's why each interview took around 30 to 45 minutes.
10	T-24	Experimental science tasks in groups	To set up experiments that teachers had not done before involved a considerable amount of thinking and innovation on our part. The teachers had to work in groups, read the tasks, select the equipment, conduct the experiment, record their observations and answer the questions asked. The tasks included finding unknown weights, the pattern of bouncing balls, the angle of friction, the number of marbles of different colours in a closed bag when only one could be taken out at a time, etc. The performance was assessed on the basis of cooperation in thinking about the solution, quality of observations, manner of taking and recording observations, sensitivity to the use of apparatus, etc.
FOR CURRENT STUDENTS			
11	T-8	Socio-economic status:	This questionnaire was similar to T-1 and sought to elicit information about the socio-economic status of the students. Questions included information about education and profession of the parents as well as family income. They were asked about their mode of transport to school, location of their homes, what vehicles and other gadgets they had at home, etc. Each response was scaled, with higher social and educational entries being ranked higher. In all, there were 20 variables, of which five were used to calculate the socio-economic index. The highest score possible was 42.
12	T-9	Conceptual understanding of science: Short answers	This was the same as T-5. However, Questions 6 and 11 were dropped from the final analysis because we felt they were inappropriate and confusing for students. The total weightage was 44.

13	T-10	Conceptual understanding of science: Multiple choice	This tool was the same as T-7 for teachers and was assessed in the same way.
14	T-11	Attitude to HSTP: Short answers	The tool had 12 questions to elicit the opinion of students on different aspects of HSTP. The open-ended questions were related to their experiences in the HSTP classroom and on field trips, their views on doing experiments, working in groups, peer group discussions, open-book examinations, etc. They were also asked about their subsequent experiences in Class IX. Answers were graded according to the kind of response and its closeness to HSTP principles. Each question was graded differently, the grading depending on the richness of the experiences shared and details of examples given, the better responses being graded higher. Questions 1, 2, 3 and 6 were graded from 0 to 5, Questions 4, 11 and 12 from 0 to 2, and Questions 5, 7, 8 and 9 from 0 to 3. The purpose of this exercise was to get a feel of what students remembered of their classroom experiences. One question related to the discussion of a particular experiment was deleted because we realised the time lag since performing the experiment was too great for students to remember specific details. Quantification was done for 11 questions, the maximum possible score being 38.
15	T-12	Attitude to HSTP: 5-point scale	This tool was administered to obtain a psychometric measurement of students' attitudes to HSTP. A multiple choice questionnaire, it had 10 questions on a 5-point agreement scale. The questions were formulated in a way that half went from positive to negative and the rest from negative to positive, implying that there was no random marking possible. The students were asked, in some cases indirectly, to give their views about *Bal Vaigyanik*, doing experiments in the classroom, memorising science, open-book examinations, etc. Question 6 was removed because we were not clear about how to rank the answers. It wanted respondents to give their opinion on the statement, "My friends liked doing experiments but did not get the opportunity to do so." We were not sure if the response related to whether their friends liked to do experiments or whether they did not get an opportunity to do experiments. Therefore, the questionnaire was rated with a maximum score of 45.
16	T-13	Attitude to HSTP:	This was another psychometric tool on a 4-point

		4-point scale	agreement scale to look at students' attitudes to HSTP from different angles. The areas examined were, again, attitude to HSTP, *Bal Vaigyanik*, open-book examinations, experiments, and the relationship of experiments to learning science. The manner in which the questions were asked was different from the 5-point scale. Here respondents had to mark the choice not in terms of the extent of agreement with a statement but their agreement with a specific form of articulation. The reason for making it this way was to collect opinions on issues that could not be converted into an agreement scale. The statements used were picked up from descriptions of HSTP by some students. Each was ranked on a scale of 1 to 4 with a maximum possible score of 40.
17	T-14	Attitude to HSTP in comparison with other subjects: 5-point scale	This questionnaire was designed while doing the first round of data gathering. We felt it was essential to place the responses to attitude questions on some comparative scale. We were not sure whether all subjects would have elicited the same kind of answers. This tool had 34 items of which 28 were on a 5-point agreement scale in which respondents had to indicate their choice of favourite subject, easy subject, enjoyment in the classroom in different subjects, being active in the classroom, level of difficulty in the examination, nature of classroom interactions, who can ask question in a class, etc. The questions were asked for both Class VIII and X and ranking was developed based on the principles and understanding of HSTP. For example, if students showed complete agreement with the view that they should also have experiment-based science in Class IX and X, they were ranked the highest. Question 23 was a 4-option question, the highest marking being 4. The total marks for this tool were 134.
18	T-15	Language proficiency: Cloze test	This was the same as T-6 and was assessed in the same way.
FOR FORMER STUDENTS			
19	T-16	Socio-economic status	This tool included 14 questions on their personal background. We created nine variables, including educational qualifications of the student, spouse, father and mother; profession of the student, spouse, father and mother; and total income of the family to determine their socio-economic. The maximum score was 84.
20	T-17	Attitude to HSTP:	The tool had seven questions meant to elicit the

		Short answers	opinion of respondents on different aspects of HSTP. The questions related to science in Class VI, VII and VIII, experiences in the classroom, incidents and experiments they remembered, effects of HSTP on their lives, their opinion on the closure of HSTP, attitude to *Bal Vaigyanik*, classroom experiences in other subjects and HSTP linkages with Class IX. The maximum score was 16. Questions 1 and 3 were marked out of 3 and the rest out of 2. Grading was done on the basis of the closeness of responses to HSTP principles and the richness of the experiences shared and details of examples given.
21	T-18	Attitude to HSTP: 4-point scale	This was the same as T-13. The maximum score was, therefore, 40.
22	T-19	Conceptual understanding of science: Multiple choice	The similar tool for current students (T-10) had 19 questions, with four possible answers each. The respondents were supposed to choose one of them. Of these, only 10 questions were retained for former students. The retained questions were designed to test conceptual understanding and had many closely matching answers based on commonsensical but erroneous notions of science. The deleted questions were those requiring specific terms or concepts not usually used in life. We did not expect these students, who had passed out of school over 15 years ago, to remember these terms and concepts after so long. Each question was of 2 marks and was marked 0 to 2.
23	T-20	Attitude to HSTP: 5-point scale	This was the same as T-12. However Question 6 was rectified to make it unambiguous. It asked whether everyone got a chance to do experiments or not. Therefore, all 10 questions were taken and the total score was 50.
24	T-21	Attitude to HSTP in comparison with other subjects: 5-point scale	This was the same as T-14 and was marked in the same way. Questions related to their feelings about Class X subjects in the present context were deleted. That left 15 questions. Some had only four options and were marked with gaps in the scores. The best grade for each question was always 5. The maximum score was, therefore, 75.
FOR PARENTS			
25	T-25	Interview of parents	The interviews were conducted by two people visiting the parents of students who were part of the respondent sample. The parents were asked questions to elicit their understanding of HSTP, their opinion about the programme, what they remembered about their children's behaviour, etc.

			With their permission, the interview was recorded and analysed qualitatively.

3.5 Procedure

As mentioned earlier, we invited all the trained teachers of Harda SGK to participate in the study. Lists were prepared on the basis of documents available at the Eklavya office and modified in line with information about the present posting of the teachers. The final sample size was 35 teachers. Two meetings were held, with 17 teachers in the first cycle and 18 in the second.

3.5.1 Teachers

In both meetings, the teachers were first given the following three questionnaires:

- Personal data sheet – socio-economic status (T-1).
- Attitude towards the HSTP – short answer questions regarding experiences and views on science teaching (T-2).
- Attitude towards the HSTP - 5-point agreement scale (T-4).

The second batch was given the following four additional questionnaires:

- Reading comprehension (T-3).
- Conceptual understanding of science - short answer questions (T-5).
- Hindi language proficiency: Cloze test (T-6).
- Conceptual understanding of science - multiple choice questions (T-7).

After filling in the seven questionnaires, there was a lunch break. This was followed by the experimental science task. The teachers were randomly divided into groups of four. Each group was asked to pick a paper slip out of seven slips, each containing a different task.

The groups then devised the experiment detailed in their slip, chose the equipment, and did whatever was needed to fulfill the task. They were free to ask for whatever material they needed. One teacher from each group kept notes of the process and discussions. The rest performed the experiment and tabulated details of the experimental set up, observations, results and conclusions.

One member of the study team was assigned to each group as an observer. Apart from taking notes of the discussion, processes, etc the observer also asked questions about the experiment and the underlying concepts. Another study team member then took the viva. The observers were not allowed to make suggestions or correct the teachers if they felt they were moving in the wrong direction.

The teachers were then supposed to present their work to the whole group and discuss the outcome. However, the discussion could not take place because the groups finished their tasks at different times, after which the teachers were too tired and wanted to return to their daily chores. Their recordings of their work were also sketchy, although the study team members took more detailed notes and prepared a comprehensive report of the group tests.

The qualitative grading of performance, based on the observations of the study team members, took into account the following parameters:

- Discussion and cooperation in the group.

- Handling of apparatus.
- Skill and care in doing the experiment.
- Whether any help was required and whether help was provided.

Some time was also given to the teachers to complete their personal data sheets and the questionnaires on attitudes to the HSTP and science (descriptive).

For the intensive interviews, 14 teachers were randomly chosen from the list of trained teachers. The study team members went to their homes to conduct the interviews, which were structured around the points mentioned in the checklist (T-23) and recorded on audio cassettes. The teachers were also asked to fill in the written interview schedule (T-22). The tapes were later transcribed and analysed to get an overview of what the teachers had said.

3.5.2 Current students

Prior to the actual data collection, the study team members met the school principals to discuss the objectives of the study and the process of administering the tools for the students. Since all eight questionnaires could not be completed in a single day, they were divided into two sets spread over two days. Of the five sample schools, four were close to each other in Harda town. To prevent them sharing the questions beforehand, the same set was administered in all the schools on the same day.

We encountered the following problems in the process:

- **Half-yearly examinations:** These examinations were going on in some schools, while they were scheduled with one-day or 2-3 day gaps in other schools. Thus, it was not possible to administer the tests together because of differences in the school timings.
- **Absence of the school principal:** In one school, the principal was on leave, so getting permission for data collection was a bit difficult. The person in-charge was unwilling to let the work go on for more than a day. Fortunately, he relented later and we were able to complete the process.
- **Irregular attendance of students:** We could not ensure that students who filled the questionnaires the first day came to school the following day to complete the second set. Thus, some students were absent on the second day and had to be followed up and repeatedly requested to complete the task. Some new students also filled in questionnaires on the second day. They had to be excluded from the total sample because we had scheduled the science concept short answer and multiple choice questionnaires for the first day itself.

These factors prevented us from ensuring that the same set of questionnaires was filled out on the same day in all the schools. However, when we probed the students about the study and the questionnaires, we got the impression that little sharing had occurred between schools. They didn't think the task was that important.

To summarise, the study team had to visit the schools several times to get both sets of questionnaires filled in by the students. On average, the schools allotted three hours per day for the process, which was scheduled just before or after the recess. The tools were divided in the following sets for the four schools of Harda town:

- Day 1, Set 1: Tools 8, 10, 12 and 11.
- Day 2, Set 2: Tools 9, 13 and 15.

We later realised that the tools ignored a comparison of HSTP science with other subjects. So we designed a fresh tool (T-14) for the purpose. We administered this tool with Set 2 in some schools. However, the schools that had already completed both sets had to be contacted again to administer the new tool on yet another day.

For the rural school (Handia), the tools were distributed as follows:

- Day 1, Set 1: Tools 8, 10, 13, 11 and 15 (three tools in the first half and two in the second half).
- Day 2, Set 2: Tools 12 and 9

We got the addresses of those students who were absent on the second day and visited them at home later to get the remaining questionnaires filled in. We visited the school a second time to fill in T-14 (comparison with other subjects).

3.5.3 Former students

As mentioned earlier, it was not easy establishing contact with former students for administering the tools. We discussed the questionnaires with them during the initial meeting and collected the filled in questionnaires the following day. However, some of them could not complete the task because of prior commitments, so we had to come again the next day, increasing the total time for tool administration.

There was no problem with the multiple choice tool to test understanding of science, which was filled in immediately. We did not leave this tool for those who could not attend the meeting and came later in the evening for data collection.

Most of the former students were excited about the entire exercise, although they were a bit apprehensive about filling in the questionnaires. In Handia, some former students from Apgaon Kala village could not attend the meeting so they had to be contacted individually later to get their responses.

3.5.4 Parents

After selecting the Class X sample, the names of a few students were randomly picked so we could interview their parents. The interviews were structured around the points mentioned in T-25 and were also recorded on audio cassettes. They were conducted at the homes of the students, with two study team members visiting their homes and talking to the parents. The parents made no attempt to put off the interview and seemed willing to talk, although they did not show any great interest – or animosity, for the matter. However, they seemed a bit hesitant discussing the school and the education of their children.

Table 32 (h) details the tools administered to each group and the number of respondents for each tool:

Table 3 (h): Details of Phase I questionnaires

		Teachers (n=35)	**Current students (n=250)**	**Former students (n=48)**

Personal data sheet (teachers)	T-1	T-1 [35]	T-8 [249] (add 2 Q)	T-16 (add 2 Q)
Attitude to HSTP (descriptive)	T-2	T-2 [34] (Q13)	T-11 [248] (Q12 mod)	T-17 [48]
Reading comprehension	T-3	T-3 [31]		
Attitude to HSTP (5-point scale)	T-4	T-4 [34] (Q16)		
Conceptual understanding of science (short answers)	T-5	T-5 [33] (Q17)	T-9 [226] (Q15)	-
Language proficiency (Cloze procedure)	T-6	T-6 [34] (mod)	T-14 [243]	-
Conceptual understanding of science (multiple choice)	T-7	T-7 [35] (Q19)	T-10 [250] (Q19)	T-19 [48] (Q10) (del 9 Q)
Personal data sheet (current students)	T-8		T-8 [249]	
Conceptual understanding of science (short answers)	T-9		T-9 [226]	
Conceptual understanding of science (multiple choice)	T-10		T-10 [250]	
Attitude to HSTP (descriptive)	T-11		T-11 [248]	
Attitude to HSTP (5-point)	T-12		T-12 [242]	
Attitude to HSTP (4-point)	T-13		T-13 [247]	
Attitude to HSTP (5-point) Comparison with other subjects	T-14		T-14 [243]	
Language proficiency (Cloze procedure)	T-15		T-15 [243]	
Personal data sheet (former students)	T-16			T-16 [35]
Attitude to HSTP (descriptive)	T-17	T-2 [34]	T-11 [248]	T-17 [35]
Attitude to HSTP (4-point)	T-18			T-18 [35]
Conceptual understanding of science (multiple choice)	T-19			T-19 [35]

Attitude to HSTP (5-point)	T-20			T-20 [35]
Attitude to HSTP (5-point) Comparison with other subjects	T-21	T-4 [34] (Q16 add)	T-12 [242] (Q10)	T-21 [35] (Q16 mod.)
General interview				
Interview				

The number in parenthesis [] indicates number of respondents for that tool.

Common questionnaires:

T-1 : Personal data sheet (T-8, T-16 – two questions added): same.
T-2 : Attitude to HSTP- descriptive (T-11, T-16): modified.
T-4 : Attitude to HSTP - 5-point scale (T-12, T-20) 10 questions identical.
T-5 : Conceptual understanding of science - short answers (T-9): added to question; common to students and teachers.
T-6 : Language proficiency - Cloze procedure (T-14): modified; common to students and teachers.
T-7 : Conceptual understanding of science - multiple choice (T-10, T-18): same; 9 question deleted.

4. Sample profile

4.0 Introduction

This chapter discusses different aspects of the study sample, including the breakdown into different categories, attitude towards science, conceptual understanding in science and language proficiency.

4.1. Variables in the study

We isolated the following variables to get a systematic and organised profile of our sample:

Variable	Variable name
A. Related to teachers	
V-1	Socio-economic status – SES.
V-2	Attitude of teachers to HSTP – descriptive.
V-3	Reading comprehension levels.
V-4	Psychometric measurement of teachers' attitude to HSTP.
V-5	Conceptual understanding of science based on short answer questions.
V-6	Hindi language proficiency based on Cloze test.

V-7	Conceptual understanding of science based on multiple-choice questions.

B. Related to current students

V-8	Socio-economic status – SES.
V-9	Conceptual understanding of science based on short answer questions. (Slightly modified version of V-5)
V-10	Conceptual understanding of science based on multiple choice questions. (Similar to V-7)
V-11	Attitude to HSTP - descriptive. (Similar to V-2)
V-12	Psychometric attitude to HSTP. (Similar to V-4)
V-13	Psychometric attitude to HSTP on 4-point scale.
V-14	Attitude to HSTP compared to other subjects.
V-15	Hindi language proficiency based on Cloze test. (Same as V-6)

C. Related to former students

V-16	Socio-economic status – SES.
V-17	Attitude to HSTP - descriptive. (Modified version of V-2 and V-11)
V-18	Attitude to HSTP (4-point scale). Similar to V-13
V-19	Proficiency in science based on multiple choice questions. (Similar to V-7 and V-10)
V-20	Psychometric attitude to HSTP on 5-point scale.
V-21	Attitude to HSTP as compared with other subjects. (Similar to V-14)

This report presents a preliminary analysis of the tools used for the study. A detailed analysis is still in progress.

4.2 About the teachers

(a) Socio-economic status (SES)

We collected data from 35 teachers for the seven variables listed above.

The tool for eliciting personal background and information had 17 questions. For the immediate analysis, we focused only on those four indices that gave us a reliable socio-economic index - education, education of spouse, occupation of spouse and total income of family. The maximum score for socio-economic index was 39. The mean score of the sample was (60.91%) with a standard deviation (SD) of 5.7. That suggests the SES of the teachers varied from 10 to 21, with very few above 23 or below 10. The sample was, thus, not completely homogeneous. In fact over 26% had an SES of 12 (30.77%), while six had a score of 23 or above (58.97%). Therefore, we expect a correlation between SES score and teachers' attitudes to the HSTP and proficiency levels in science and language.

(b) Attitudes to HSTP

We tried to measure attitudes to the HSTP of different categories of our sample in as comprehensive a way as possible. The attitudes of teachers were examined through two tools - T-2 and T-4 - which correspond to variables V-2 and V-4. T-2 consisted of short answer questions asking teachers to respond to HSTP issues like learner participation in the classroom, weekly/monthly meetings, textbooks, experiments and the HSTP manual. We also wanted to know their views on teacher training, open-book examinations and evaluation systems. The mean score for these descriptively measured attitudes was 18.41, with an SD of 5.96.

Table 4.1 (a): Attitude of teachers to HSTP (T-2)

Score	Respondents	Percentage
1 to 10	3	8.83
11 to 16	10	29.41
17 to 21	10	29.41
21 to 30	9	26.47
31 to 33	2	5.88
Total	**34**	**100.00**

The table shows the attitude of most teachers towards the HSTP was fairly positive, with over 64% scoring 58% or more on the attitude scale.

We also measured attitudes on a 5-point scale in T-4. This analysis, too, was extremely positive.

Table 4.1 (b): Psychometric measurement of teachers' attitudes to HSTP (T-4)

Score	Respondents	Percentage
35 to 45	2	5.89
46 to 55	7	20.58

56 to 65	9	26.48
66 to 75	13	38.23
76 to 85	3	8.82
Total	**34**	**100.00**

In variable V-4 a composite attitude scale was created based on all the questions. The maximum score one could get on this scale was 85. We noticed that the mean score was 62.38 (73.39%) with an SD of 10.47. Which means the attitude of teachers was far more positive on this scale than on the short answer scale.

(c) Language proficiency of the teachers

Language proficiency was measured through two variables. For V-3, a reading comprehension passage followed by a set of six questions was used to assess their understanding of a slightly abstract scientific text written in simple Hindi. The performance showed average capacity, with only 15 scoring above 50% (8 or above). V-6, corresponding to T-6, was a Cloze test consisting of 20 blanks. Every seventh word from the given passage had been deleted, with the first and last sentences left intact. This tool was used to test overall language proficiency. The Cloze procedure based on Gestalt psychology is a highly reliable tool to measure overall language proficiency because an equal number of function (grammatical) and content words tend to automatically get deleted in the procedure. The maximum score for this variable was 20. The mean score was 8.56 with an SD of 2.06.

Table 4.2 (a): Reading comprehension levels (T-3)

Score	Respondents	Percentage
1 to 4	2	6.67
5 to 7	12	40.00
8 to 15	16	53.33
Total	**30**	**100.00**

Table 4.2 (b): Language proficiency – Cloze test (T-6)

Score	Respondents	Percentage
1 to 5	1	2.94
6 to 8	18	52.94
9 to 10	13	38.24
11 to 15	1	2.94
16 to 20	1	2.94

Total	**34**	**100.00**

It was interesting to note that over 45% teachers scored above 45% marks in the Cloze test. A score of 45% or above is considered fairly reasonable for this procedure, though we expected the teachers to perform much better.

(d) Conceptual understanding of science

Teachers' conceptual understanding of science was measured through variables V-5 and V-7, corresponding to tools T-5 and T-7. T-5 consisted of 17 specially constructed short questions designed to examine conceptual clarity in areas where intuitive ideas often show wrong formulations. The maximum score for V-5 was 54. The teachers' mean score was 32.1 (58.43%) with an SD of 6.95. Many scored above 36 (66.6%). V-7 consisted of multiple choice questions designed to elicit their conceptual understanding. Against the maximum score of 38, the teachers' mean score was 27.31 (71.88%), with an SD of 6.49.

Table 4.3 (a): Conceptual understanding of science - short answers (T-5)

Score	**Respondents**	**Percentage**
10 to 20	1	3.03
21 to 30	11	33.33
31 to 35	7	21.21
36 to 40	9	27.28
41 to 50	5	15.15
51 to 54	0	0.00
Total	**33**	**100.00**

Table 4.3 (b): Conceptual understanding of science - multiple-choice (T-7)

Score	**Respondents**	**Percentage**
10 to 15	1	2.86
16 to 20	6	17.14
21 to 25	6	17.14
26 to 30	10	28.57
31 to 35	7	20.00
36 to 38	5	14.29

Total	**35**	**100.00**

We are in the process of carrying out a detailed analysis of the responses of teachers but it was clear from the above figures that their understanding of even counter-intuitive ideas in science was reasonably good.

Some of the tools used to elicit attitudes to the HSTP and conceptual understanding of science were common to the three groups of our sample viz. teachers, current students and former students, although in slightly modified form. It would be interesting to compare the variables across the three groups.

4.3 About current HSTP students

(a) Socio-economic status (SES)

We worked with a total of 250 current students. We used T-8, a questionnaire that focused on income, education and occupation of parents, to elicit their socio-economic background. Against the maximum SES score of 46, the students' mean score was 12.43, with an SD of 6.07. That suggests most of them came from fairly poor socio-economic backgrounds, with scores ranging from a maximum of around 20 to a minimum of about 5. Those at the lower end of the scale were obviously from poor families.

(b) Conceptual understanding of science

Table 4.4 (a): Conceptual understanding of science – short answers (T-9)

Score	**Respondents**	**Percentage**
1 to 7	70	30.97
8 to 14	98	43.36
15 to 21	46	20.35
22 to 28	8	3.54
29 to 35	3	1.34
36 to 44	1	0.44
Total	**226**	**100.00**

In T-9, we tried to examine the conceptual understanding of science of current HSTP students through 13 short questions. The maximum possible score was 44, their mean score being 10.84, with an SD of 5.99, which was very low. Most scored from 8 to 21, with only four topping 30. The questions tested their views on elements of science that appear to be counter-intuitive. The expectation was that they would articulate their responses in a couple of sentences. The approach was indirect since we were aware that these students had last responded to issues like these a couple of years back and were now part of a routine that

expected them to reproduce answers told to them. The performance indicated that we needed to simplify the test items to some extent.

Table 4.4 (b): Conceptual understanding of science - multiple choice (T-10)

Number	Respondents	Percentage
1 to 7	5	2.00
8 to 14	103	41.20
15 to 21	96	38.40
22 to 28	44	17.60
29 to 38	2	0.80
Total	**250**	**100.00**

We designed T-10 to test some aspects of conceptual understanding of science through multiple choice questions. The maximum possible score in this case was 38, the mean score of the students being 16.62 (44%), with an SD of 5.29. Students performed better in this test compared to the short question-answer format, indicating that linguistic articulation is possibly a problem for them. This test was structured to be much simpler than the earlier test. However, Questions 5, 6, 8, 9 and 16 still appeared difficult for them. They probably interpreted some questions differently, so these may have to be examined and rephrased for the final study.

While the performance was just about average, we can make meaningful statements about their conceptual understanding only when a comparative sample is studied.

(c) Attitudes to HSTP on a qualitative scale

Table 4.4 (c): Attitude to HSTP - short answers (T-11)

Number	Respondents	Percentage
1 to 7	5	2.02
8 to 14	47	18.95
15 to 21	98	39.52
22 to 28	83	33.46
29 to 38	15	6.05
Total	**248**	**100.00**

We were keen to measure the attitudes of current students in as detailed a manner as possible, so we used four different tools to examine different aspects. For example, T-11 asked them to respond to some basic defining features of the HSTP. It sought to elicit a qualitative evaluation of these aspects, such as long-term experiments, experiments conducted in small groups, their experiences while conducting specific experiments, field trips, open-book examinations, etc. We codified their answers in different categories and then quantified them. The maximum possible score was 38, the mean score of the students being 19.63, with an SD of 5.87. This suggests that attitudes of current students were significantly positive and articulated explicitly in writing, not just by putting a tick on a scale. Questions 11 and 12 need to be reconsidered, since they expect a certain level of rigour in scientific attitude that is counter intuitive, or they expect recollection of long past events. The choice of words in these questions may also be confusing – for example, *yantra* may be taken to mean equipment.

(e) Attitudes to HSTP on a quantitative scale

T-12 consisted of 10 statements half of which were negative and the other half positive in the context of the HSTP. We felt one statement was not clearly worded so we ignored it for our calculations. The maximum possible score for the remaining nine statements on a 5-point scale was 45, the mean score being 32.81 (72.92%), with an SD of 4.99. That indicated that attitudes to the HSTP on this quantitative scale were highly positive.

We asked a few more questions in T-13 to elicit the attitude of students towards their teachers, teaching methods, group work, field trips and open-book examinations. We used a 4-point scale for such aspects as open-book examinations, experiments and their relationship to learning scientific concepts, etc. The maximum possible score in this case was 40, the mean score being 33.97 (84.91%), with an SD of 4.49. Here again we found that attitudes to the HSTP and its conceptual underpinnings and implementation were highly positive.

In both cases the mean scores were high and the standard deviation small, indicating that a large part of the student population was centred on high mean scores. In fact the median and mode was 33 and 34 respectively in T-12 and 35 and 36 in T-13. This clearly shows that attitudes to the HSTP were extremely positive. Since the sample was large (250 students) and the schools were chosen at random, the reliability and validity of the results were unquestionable.

Table 4.4 (d): Psychometric attitude to HSTP - similar to V- 4 (T-12)

Score	Respondents	Percentage
15 to 25	16	6.61
26 to 30	59	24.38
31 to 35	98	40.50
36 to 45	69	28.51

Total	**242**	**100.00**

Table 4.4 (e): Psychometric attitude – 4-point scale (T-13)

Score	Respondents	Percentage
15 to 20	5	2.02
21 to 25	11	4.45
26 to 30	31	12.55
31 to 35	91	36.85
36 to 40	109	44.13
Total	**247**	**100.00**

(f) Comparison of attitudes to HSTP science and other subjects

Table 4.4 (f): Attitude to HSTP compared to other subjects (T-14)

Score	Respondents	Percentage
50 to 70	10	4.12
71 to 80	47	19.34
81 to 90	89	36.63
91 to 100	75	30.86
101 to 134	22	9.05
Total	**243**	**100.00**

We designed T-14 to examine how students compared HSTP science to other subjects they were studying. It also sought to look at their current attitude to science and the claims the HSTP made about linkages with Class IX and X. The questionnaire had 34 items and the total possible score was 134. The mean score for all students was 87.29, with an SD of 10.32, the median being 87 and the mode 86. Once again, we notice that attitudes towards the HSTP science as compared to other subjects were highly positive.

We think such positive attitudes, measured and elicited in a variety of ways in our study, should be regarded as one of the major achievements of the HSTP in terms of its principles and implementation. They clearly show that the HSTP made the classroom and school

worth their while for the students, who enjoyed learning science by actually doing experiments, making observations and analysing their results on their own.

(g) Hindi language proficiency

Table 4.5 (g): **Language proficiency – Cloze test, same as V-6 (T-15)**

Score	**Respondents**	**Percentage**
1 to 5	56	23.05
6 to 8	71	29.22
9 to 10	67	27.57
11 to 20	49	20.16
Total	**243**	**100.00**

As already pointed out, we designed T-15, a Cloze test, to assess the students' proficiency levels in Hindi. The maximum possible score was 20, the mean score being 7.85 with and SD of 3.12. Even the best students got only 51-52% marks. However, since we based our scores on exact retrievals only and did not include acceptable entries, a mean score of about 40%, though not up to the mark, was reasonable. Hence it was clear that though the students study in Hindi and also study Hindi as a subject, their proficiency levels in the language were rather low. This may well be an important reason for their poor performance not only in the HSTP but in other subjects as well.

4.4 About former HSTP students

This section considers former HSTP students presently in the 25-35 years age-range. Born around 1975-1978, they studied the HSTP science around 1987-1990. We could get data from 48 such students. It is clear from their personal background and socio-economic data that we captured a widely differentiated spectrum, the mean SES score being 22.60, with an SD of 22. That suggests we had people with scores ranging from 1-2 to 44-45 on a scale of 0 to 74.

(a) Attitudes to HSTP

We were particularly keen to understand their attitudes to the HSTP, so we decided to use most of the tools developed for current students. Some were simplified, keeping in mind the fact that many former students may not be formally dealing with scientific concepts in their present occupations.

The simplified tools included T-17, T-18, T-20 and T-21. T-17 was qualitative in nature, being based on written responses to questions, while T-18, T-20 and T-21 were quantitative. In T-17, we asked the former students to reflect on their experiences of studying HSTP

science in school and quantified their responses. Against a maximum possible score of 16, their mean score was 10.52, with an SD of 3.42, the median and mode both being 11. This shows that they remembered their HSTP days with a sense of nostalgia. Their attitude was even more positive than that of current students who are still in touch with changes occurring around them.

T-18, exactly similar to T-13, measured attitudes to different aspects of the HSTP on a 4-point scale. The mean score was 33.13, with an SD of 5.46 - figures very close to those of current students. T-20 was similar to T-12, except for one ambiguous statement in the latter which we rectified. The maximum possible score was 50, the mean score being 37.21 with an SD of 6.49. We found the mean score was close to 4 on a 5-point scale in all the 10 statements in the scale, once again reflecting the highly positive nature of their attitudes.

(b) Conceptual understanding of science

We administered only one questionnaire to former students to examine their understanding of basic concepts they had been exposed to in middle school because we found that most had branched of into different areas and were out of touch with science. Moreover, they could not give us sufficient time to go into a more detailed appraisal. T-19 was a multiple-choice questionnaire with a maximum possible score of 20. On average the former students scored from 14-15 to 7-8 marks, the mean score being 10.58 (53%), with an SD of 3.57. We consider it a substantial achievement that even after a gap of 15-20 years they have a fairly clear understanding of some scientific concepts emphasised in the HSTP.

4.5 Conclusion

Our sample profile clearly reveals that all three categories - teachers, current and former students - had highly positive attitudes to the HSTP. However, we found that language proficiency levels of both teachers and students were not very good. It would be interesting to examine whether poor language skills influences conceptual understanding of science. We noticed that conceptual understanding was reasonably good among teachers and former students but the performance of current students fell below expectations. The next chapter looks more closely at our analysis of the responses. However, it would be premature to make a definitive statement on this aspect at this juncture. For that, we would first have to undertake a comparative study with a control sample of non-HSTP students.

5. Correlation analysis

5.0 Introduction

This chapter examines the relationship between attitudes to the HSTP, conceptual understanding of science, language proficiency and socio-economic background for all three categories of our sample, namely teachers, current and former students.

5.1 Teachers (n=46)

If we examine the correlation matrix in Table 5.1, we notice that socio-economic status had no role to play. It did not correlate significantly with any of the other variables. However, the different techniques used to measure conceptual understanding of science i.e. variables V-5 and V-7 corresponding to tools T-5 and T-7, correlated highly significantly ($r = .59$, $p \leq$

.001). Thus, those who did well in the multiple choice test also did well in the short answer test.

The crucial issue was to find what kind of variables correlated most significantly with conceptual understanding of science. It is clear from Table 5.1 that attitudes to the HSTP and proficiency in Hindi correlated significantly with conceptual understanding. The correlation coefficient of reading comprehension with conceptual understanding was r = .38, and that of attitudes to the HSTP with conceptual understanding was r = .31, both significantly high.

Similarly, there was a high correlation between the Cloze procedure and conceptual understanding of science (r = .35). Although not significant, the correlations between attitudes and Cloze, on the one hand, and conceptual understanding measured through the multiple-choice test, on the other, were positive (r = .24 and .22). The picture that emerges is that attitudes to the HSTP and proficiency in language are what matter most in conceptual understanding of science.

Table 5.1 Correlation matrix (teachers)

No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
	SES	**Attitude (short answers)**	**Reading comprehension**	**Attitude (5-point+ multiple choice**	**Conceptual understanding (short answers)**	**Language proficiency Cloze test**	**Conceptual understanding (multiple choice)**
1.	1	.11	.16	-.23	.20	.09	-.08
2.	-	1	.15	.08	.31	.37	.24
3.	-	-	1	.02	.38	.23	.02
4.	-	-	-	1	.24	.03	.15
5.	-	-	-	-	1	.35	.59
6.	-	-	-	-	-	1	.22
7.	-	-	-	-	-	-	1

5.2 Current students (n = 250)

Since the current student sample was large, even small correlation values were highly significant. The correlation matrix is given in Table 5.2.

Table 5.2 Correlation matrix (current students)

	8	**9**	**10**	**11**	**12**	**13**	**14**	**15**

No	SES	Conceptual understanding (short answers)	Conceptual understanding (multiple choice)	Attitude (short answer)	Attitude (5-point)	Attitude (4-point)	Attitude other subjects (5-point)	Language proficiency (Cloze test)
8	1	.160	.116	.185	.110	.083	-.004	.248
9		1.00	.417	.150	.171	.031	.062	.303
10			1	.152	.031	.064	.038	.185
11				1	.233	.261	-.087	.165
12					1	.134	.181	.156
13						1	.039	.021
14							1	-.002
15								1

V-15 (proficiency in Hindi language measured through the Cloze procedure) seems to be a key variable since it correlated highly positively with a cluster of attitudinal and conceptual understanding of science variables (V-11, V-12 and V-9, V-10). Proficiency in Hindi also correlated highly significantly and positively with socio-economic background (V-8).

Table 5.2 reveals that SES was associated with conceptual understanding of science, as seen in short answer questions (V-9, r = .16) and attitudes to the HSTP (V-11, r = .19). Thus, it is possible that students who came from relatively better socio-economic backgrounds had more positive attitudes to the HSTP and a better understanding of scientific concepts.

Conceptual understanding measured through short answer questions (V-9) was strongly correlated with conceptual understanding measured through multiple-choice answers (V-10), ($r = .42$, $p \leq .001$). It was also positively correlated with language proficiency and attitudes to the HSTP.

We notice that attitudes measured through three different tools (T-11, T-12 and T-13) correlated strongly with each other and they all, in turn, correlated with language proficiency.

We may draw the following conclusions:

- The higher the socio-economic status of the student, the higher was her/his proficiency in Hindi.
- The higher the proficiency in Hindi, the more positive was attitudes to the HSTP.
- The higher the proficiency in Hindi, the better was the conceptual understanding of science.

Notice that these relationships are not at all causal; at best they are correlational.

What emerges clearly from this discussion and obviously demands further research is that variables corresponding to attitudes to the HSTP, language proficiency and conceptual understanding in science tend to correlate strongly with each other. This complex network of correlated variables may have pedagogical implications for material design, teacher training and classroom transaction.

5.3 Former students (n = 48)

Table 5.3 Correlation matrix (former students)

No.	16	17	18	19	20	21
	SES	Attitude (short answer)	Attitude (4-point)	Attitude (multiple choice)	Attitude (5- point)	Attitude other subjects (5-point)
16	1	-.028	-.347	.563	-.065	.208
17		1	.322	.093	.284	.192
18			1	-.091	.327	.061
19				1	.217	.308
20					1	.200
21						1

Table 5.3 reveals some interesting correlations among variables in the case of former students. SES did not seem to be significant as far as attitudes are concerned, except in the case of V-18, where there was a significant but inverse correlation. It suggests that those who came from the lower socio-economic strata were more positively inclined towards the HSTP. However, SES had a very high positive correlation ($r = .56$, $p \leq .001$) with conceptual understanding of science, suggesting that those who came from relatively better socio-economic backgrounds had a better understanding of scientific concepts.

Another interesting correlation was between V-19 and V-21 ($r = .31$) suggesting that those former students who possibly did well in HSTP science liked it more than other subjects in their middle school years.

5.4 Conclusions

The correlation analysis in this chapter has given us several useful insights. We may summarise them as follows:

- Language proficiency is a key factor in understanding scientific concepts. For all the groups in our sample viz. teachers, former students and current students, there was a significantly high and positive correlation between language proficiency and conceptual understanding in science.

- Attitudes to the HSTP seem to be of central importance. We consistently noticed a high and positive correlation between attitudes and achievement tests in conceptual understanding of science.
- It would appear that any successful implementation of a project like the HSTP would depend on a simultaneous effort to cultivate positive attitudes towards it and enhance the language proficiency of students.

6. Qualitative data analysis

6.0 Introduction

This section is based on the following sources of data:

- Recorded and written interviews of 20 teachers.
- Written responses to T-2 (teachers).
- Written responses to T-11 (current students)
- Written responses to T-16 (former students)

The responses to T-2, T-11 and T-16 have been quantified and included in the earlier analysis section as well. We present below a preliminary qualitative analysis of the data. A comprehensive analysis of this substantially large database will need some more time.

6.1 Written and recorded interviews with teachers

As mentioned earlier, we first drew up a list of 155 teachers who had undergone the cycle of HSTP trainings (Class VI, VII and VIII). The information was provided by the District Education Office and reconfirmed by fellow teachers. From this list, we randomly chose 19 teachers for the interviews. Of these, three refused to be interviewed, though one changed his mind in the second round. Two could not be traced as they were transferred from Harda long ago. One teacher was not present in Harda during the time of the interviews.

Therefore, only 14 of the selected sample were interviewed. However, we were able to interview six other teachers who were selected on the basis of their experience and long association with the programme, bringing the total of recorded interviews to 20 teachers. All of them had undergone training for the three classes and are either still teaching or taught science before retiring from service.

6.2 Method of recording

In the beginning, many interviewees were not too enthusiastic. They were tense, cautious and not very forthcoming. Though the purpose of the study was explained to them, their worry was that their statements may be used to put pressure on the government to restart the programme. Since most were still in service, they thought this could land them in trouble. The interview team was, however, slowly able to win their confidence and elicit frank responses.

The teachers either came to the Eklavya office in Harda for the interviews or two team members went to their residences. One asked questions from the questionnaire, while the other asked supplementary questions, whenever the situation demanded. After the interviews, the schedule of questions requiring written responses was handed over to them and collected a day or two later.

6.3 Findings

6.3.1 Training

The first four questions related to their experiences of HSTP trainings and a comparison with subsequent science trainings. The consensus among the teachers was that the HSTP trainings were better organised, better managed, had better content and were more meaningful and participative. Two teachers who were critical of many other aspects of the

HSTP had only positive things to narrate about the trainings. The teachers were happy with all aspects of the trainings, saying they were of high quality. Based on their experiences, they highlighted the following aspects:

- Trainings for the three classes were spread over three years, which gave sufficient time to absorb, reflect and discuss in detail. During the trainings, the group process helped in learning from one another. When many minds are put together, there is more learning.
- Each training lasted for almost 20 days during which time they felt they had been exposed to a wide spectrum of scientific knowledge.
- During trainings, teachers were given opportunities to conduct experiments and seek answers to questions. This helped them later in actual classroom situations. Teachers said they personally learnt a lot in the process.
- Compared to other trainings, the experiments in the HSTP were actually performed by the teachers, which helped build up their understanding of science. The experiments and the language of discussions were simple and teachers found the training style easy to grasp.
- All the experiments from the workbook were done and discussed during the trainings. This helped the teachers in managing the classroom processes with greater confidence.
- Experiments were always followed by discussions, unlike in other trainings where experiments are just formalities.
- The teachers got opportunities to discuss the kind of questions that students ask in class, which helped them in handling their own classes with a 'free mind'.
- The engagement was at a deeper level in HSTP trainings. This was not the case with other trainings where teaching is either through lectures or writing on the backboard. The emphasis in the HSTP was on building conceptual understanding, which is often missing in other trainings.
- In other trainings, there is no involvement and enthusiasm as there are no practicals. Everything is completed within 2-3 hours.
- There was no 'boss' in HSTP trainings. The role and behaviour of the resource persons were different from that of trainers in other trainings. "I attended an English training conducted by a government organisation. It was a joke," recalled one teacher.
- About 70% of the teachers said they could easily manage new situations with ease after the HSTP experience. They felt that learning in HSTP trainings was so comprehensive that they were even able to demonstrate experiments from the new textbook following the closure of the programme. In fact, they perform experiments wherever possible while teaching science from the new books.

- In response to a supplementary question regarding the environment during HSTP trainings, one teacher said with forceful conviction that there used to be equality during interactions even though professors from universities and colleges came to give the trainings.

- Another supplementary question regarding the academic levels of the resource persons evoked a response from almost all the teachers that they were high quality intellectuals, many of them university professors/heads of department.

- One teacher referred to the exercises (*Laghu prashn*) given after completing each chapter when asked about the way in which conceptual clarity is arrived at.

6.3.2 Teacher-student relationship

There were three questions around this theme. By and large, teachers were positive about their relationship with students, the change in the learning environment and their changed role in the classroom. A few were, however, apprehensive about such changes and feared the erosion of the teacher's authority and students becoming rowdy. They also showed concern about the disjunction with higher classes. The salient points elicited from the responses are as follows:

- The HSTP changed the student-teacher relationship. Students, too, articulated this difference and would come to the class expecting to do experiments. They would bring a lot of materials from home to conduct experiments. (These observations were corroborated by former and current students in T-16 and T-11.)
- The HSTP helped create better bonding between teachers and students and made the classroom environment more interesting.
- Students used to ask questions earlier and they do so even now. What had changed in the HSTP was the role of the teacher. It gave the teacher the confidence and ability to handle students coming up with different answers to the same question, taking cues from their own experiences during their training sessions. (Some teacher comments: "We have become more confident as teachers." "Earlier, we used to be scared of children's questions, not any more." "With our enhanced knowledge, we are able to teach better." "We did experiments with the children and could teach them better.")
- When there was no HSTP, students used to sit in rows in the classroom, while in the HSTP they performed experiments in groups. Working in groups brought teachers closer to the students.
- Students were excited and took interest in doing experiments, as this was a new thing for them. The teachers, too, took more interest because of the change in their expected role.
- In the HSTP, the teacher also became an inquisitive child. He/she became a friend who understood the students' emotions.
- Students were not afraid to give their views even if the teacher was not satisfied with them. They became more articulate and gave different answers.
- However, there were also drawbacks to such a closer relationship. With greater freedom students became more active, eroding the teacher's authority. Since the teacher was their friend, students often took advantage of the situation. The closer the students came, the worse it was for the teacher.
- There were also practical problems in handling large classes. Thus, despite their willingness, teachers were often not able to teach properly.
- Schools with large classes faced problems in organising the classes. Group work and performing experiments was not possible in such schools.
- Under the HSTP, students learnt through experiments till Class VIII. But there was a disjunction after this as there are no experiments in Class IX and X.
- HSTP students faced problems in the higher classes because they had to learn chemical symbols and equations, which non-HSTP students already 'knew'.

6.3.3 Views on open-book examinations

One teacher did say the purpose of open-book examinations was to remove the fear of examinations from the student's mind. However, most teachers were not clear about their purpose, so we had to pose some supplementary questions. Though they agreed that the possible objective was to help students, they still felt it confused students, leading to wastage of crucial time during examinations.

6.3.4. Long-term experiments

Teachers said they had done long-term experiments during their trainings and realised the importance of such experiments in learning science. Supplementary questions revealed that 50-60% of them had conducted these experiments in their classes as well. They were familiar with the concept and enjoyed doing them. They recalled three or four examples of experiments done by students under their guidance and narrated their experiences. The examples included development of embryos in eggs, germination of seeds and development of insects from caterpillars.

The common concern was that many long-term experiments could not be done due to shortage of time and practical problems. Two teachers did not understand the question, though a supplementary question did clarify things for one of them.

(T-16, T-11 showed that former and current students also fondly remembered performing such experiments. Some of them also gave detailed accounts, including the underlying principles and conclusions obtaining from them.)

6.3.5 Field trips (*Paribhraman*)

Most teachers said field trips were part of the chapters and they had gone on such trips during trainings as well. All said they took students on field trips, a fact borne out by the statements of the students (T-16, T-11). The general practice was to have only one field trip per year in which all aspects that needed looking into were dealt with together. As a result, several things remained sketchy. Some schools, however, conducted two to three field trips per year. Some times field trips were organised on holidays as well and teachers and students made advance preparations for them. Teachers would take students in groups of 50-60 for field trips.

When asked about the need for field trips as opposed to asking students to bring the required leaves, insects, flowers etc to the class, one teacher responded by saying it was not the same thing. Other teacher comments: "You cannot bring a whole tree or hillock to the classroom." "Observing diversity in natural surroundings is essential." "You cannot bring all the leaves to the classroom." "Study of botany can be done only through field trips." "Field trips help in creating awareness about the environment among students." "Teachers and students come closer during field trips."

Against this, one teacher mentioned that most field trips were planned for July-August, which was during the monsoon period, and there was danger of students slipping and getting hurt. So students could not be taken on field trips.

(Students also spoke in detail about their experiences during field trips - T-16 and T-11. Their responses showed that they not only enjoyed the trips but remembered them as memorable

learning experiences. Their articulations were sharper and more lucid than those of the teachers, reflecting considerable learning from these events.)

6.3.6 Are children like wet clay?

About 80% of teachers asserted that parents play a greater role than teachers in learning. Here are some of the comments voiced on this issue:

- "No, children are not like empty pots. They are neither this nor wet clay. When they come to school, they know a lot. The teacher only plays the role of a catalyst."
- "When children come to us they are quite knowledgeable. Our role is to help refine their knowledge, which comes from their family and society."
- "Yes, a child learns as much as the teacher teaches, so the teacher's role is important."
- "The teacher's role is important but so is the parent's role in improving the future of children."
- "Yes, the teacher is responsible, but parents are the first teachers."

Thus, by and large, the teachers do not consider students as wet clay or empty vessels. They are aware that students have knowledge prior to coming to school. But whether it means that teachers understand concepts like 'construction of knowledge' or 'constructivist approaches' is unclear. Perhaps not, but they do appreciate and understand the student's knowledge base.

The question about the impact of the HSTP on teaching other subjects did not receive many insightful responses. Although the teachers appeared eager to articulate something they felt, they did not quite know how to put it into words. "This has helped us understand children better," said one of them.

Does the HSTP have the potential to make students inquisitive in other subjects like it does in science? Though the question did not receive many deeply thought out answers, some teachers did ponder the issue. Their responses were varied:

- "No, science has more scope, geography does not have that kind of potential."
- "Children used to be very active in the science classes. They would often ask questions in the social science classes as well, but rarely in the maths classes, even though I used to teach both maths and science."
- "Yes, maybe even social science could be made more critical."

6.3.7 Impact on self image

Almost 60% of the teachers said they were not scared of teaching science after the HSTP experience. They did not feel the need to rote memorise things. They were more confident, got more respect and could deal with any question while teaching. They became more expressive and could say things without fear. They could thus face any officer with confidence. It was because of this confidence they are now able to deal with the new science textbooks creatively and confidently.

There was not much response to the direct question about changes in their behaviour, apart from their earlier observations on their relationship with and behaviour towards their students. Only one teacher said his attitude had changed and he no longer believed anything unless he saw things with his own eyes.

6.3.8 Creator of knowledge

None of the teachers could give an accurate response to this question that tried to evoke their view of their role as creators of knowledge. We were either unable to explain the question to them and, hence, they found it difficult to respond, or else they saw creation of knowledge as something outside the purview of teachers. However, this was in conflict with their replies to other questions. It also indicates that the HSTP interactions had not dealt with such ideas adequately.

6.3.9 Closure of the programme

None of the responses to questions about the closure of the HSTP revealed any sense of anger or sadness about the event or displayed a sense of closeness to the programme. Some had liked it, others had not, but they all felt they had no role either in its closure or continuation. The impression was that, to most of them, the HSTP was just another programme that had been shut down. They saw their role as government servants who did what they were asked to do.

They had adapted to the new situation. The change in expectations from science classrooms post-HSTP did not seem to create a dilemma in their minds. A few teachers did say the transition was a bit difficult but the overwhelming majority was satisfied with what was happening in their science classes after the HSTP. The message did come across that they were trying their best to do experiments and use what they had learnt in the HSTP in their current science classes. Apart from this they expressed concern about the need for stronger linkages between the HSTP and science in Class IX and X.

However, it did seem that some of them were not responding to specific questions freely and frankly. Their answers were extremely guarded and carefully constructed.

6.4 Qualitative analysis of the written responses of former students (T-16)

This questionnaire was given to 40 selected former students. Most of them had studied HSTP science more than a decade and a half ago. They were either engaged in their own small business or in a job. Many could not pursue their studies to the graduate level. The effort was to elicit their understanding of the HSTP based on their classroom experiences and to see whether these experiences had influenced their thinking, attitudes and world view.

The first of the seven questions concerned the method of science teaching in the HSTP class. By and large, the responses showed that experiments were conducted and formed an essential part of learning science. It is important to point out that many of the students remembered the processes quite clearly even after such a long time gap. However, a few did write that they were taught science by ‘writing on the blackboard’, which suggests they did not learn science by doing experiments in their schools. But for many learning science through experiments remained the overriding image. The following points emerge from their responses:

- Experiments were done in the science classes.
- Without experiments, it is not possible to understand science.
- While doing experiments they worked in groups.
- Experiments were conducted to build a deeper understanding.

- Many said that learning by doing was the mainstay and it led to a better understanding of science compared to rote learning.
- The emphasis was also on learning from the environment and teachers used to take students out of the classroom to directly experience plants, clay, insects, farms etc. Teachers did long-term experiments related to the life cycles of insects and other living things. Students observed and recorded the changes. An understanding of crop diseases was built by actually observing diseased plants in the fields.

The answers reveal that students were engaged in intensively analysing their observations in addition to doing experiments.

The second question asked them to recount any special incident during their HSTP days. The responses were quite interesting. One student wrote that the group process gave them an opportunity to make friends. Others said they remembered their friends in the context of the experiments or related incidents. That is, friendship was also an experience in learning from one another and this memory is clearly etched in their minds. They remember the academic content of their friendship, with many writing about interesting biology experiments and field trips when asked to relate an interesting episode.

A few remembered their visits to the Eklavya centres where they observed and learnt many other things. Others said the programme helped build the confidence of students, who learnt to solve problems on their own.

Regarding the *Bal Vaigyanik* workbook, most said it was an interesting book that contained a lot of do-able experiments. All said it was more for performing activities, unlike other textbooks. The former students made the following points:

- It was different from other textbooks. It was interesting and made the subject interesting. Students enjoyed learning science while they had to work hard for the other subjects. Many students said, “We used to wait for the science class.”
- One student said she never felt like leaving the book and the science class. It gave her an opportunity to ‘do experiments with her own hands’.
- It made science easier. It was friendly and not boring. It cultivated curiosity.
- It completely uprooted the method of rote learning. In other subjects, students had to memorise and learn by rote.
- The teaching method was different. Answers to many questions had to be found by the students themselves.

Overall, the impression that emerges is that the students learnt many new things and did quite a few interesting experiments. One wrote that this programme helped in developing a scientific attitude. The teachers also emphasised the aspect of learning from peers, so it can be safely inferred that conducting experiments in groups encouraged academic interactions among students.

There were problems as well. A few clearly remembered having only one microscope for 80 students and not being able to observe onion cells, one of the most interesting and important experiments. Students from English medium schools wrote about the non-availability of English edition workbooks. Some also said that private schools did not send their teachers for training hence they were not able to teach well. One student wrote that some teachers were not serious about teaching the subject.

On the issue of closure of the HSTP, no respondent said the programme was harmful in any way. They raised issues related to the struggle to reform and improve the system and the obtuseness of the system to change. One even said it was good the programme was closed down, considering that the teachers did not take their work seriously.

The issue of disjunction with the higher classes was also raised in this context. One of their demands was to extend the HSTP methodology to the higher classes as well.

"The closure means children will not get the opportunity to do experiments," many said bluntly, adding that students would never get the right information. "The weaknesses of HSTP should have been removed instead of closing it down," said one respondent.

On the issue of linkages with the higher classes the focus was on finding out whether any efforts had been made to assess the advantages and disadvantage of the HSTP in the higher classes. Generally, the responses were mixed. Some said that Class IX science was tough and they missed the fun of doing experiments and learning through them. They clearly missed this 'science' in the higher classes. Some pointed out that the understanding of science that the HSTP developed helped in learning science in higher classes.

6.5 Qualitative analysis of written interviews of teachers (T-2)

The teachers who were interviewed were also given a questionnaire whose objective was to understand the changes they had to make in their science classes after the HSTP closure. The effort was also to understand how far they had imbibed the HSTP's spirit and methodology. The questionnaire highlighted the following aspects:

- Freedom for students to ask questions during the class.
- Challenging the general notion that the teacher knows everything.
- Providing a forum for teachers to voice their administrative and academic concerns.
- Availability of required materials for science teaching.
- Class environment.
- Nature of teacher training to make science teaching meaningful.
- Importance of field trips in science teaching.
- Examination system and the redistribution of marks.

6.5.1 Freedom to students to ask questions in the classroom

Teachers who expressed their views on this issue said students are curious by nature and ask questions related to the subject as well as about the world in general. Most teachers said that given the opportunity, all students ask questions and none of their questions are irrelevant.

6.5.2 Teacher knows everything

The general notion of a teacher is that she should know the answers to all questions. This is what is conveyed to them during their various training programmes. In the HSTP, the effort was to change this conventional image of the teacher. The teachers' answers suggest that they believe that if they don't know the answers to questions raised by students, subject experts and books should be consulted. Such issues should also be discussed in monthly meetings. Some teachers, however, said the teacher should be a master of the subject he teaches and should answer all the questions students ask.

6.5.3 Forum for resolving administrative and academic issues

Many teachers wrote that monthly meetings were regularly held during the HSTP. Some also commented on the monthly meetings held at the Jan Shiksha Kendras in the present context, pointing out that these teacher-parent meetings are unlike the HSTP meetings where academic issues were discussed, analysed and resolved. Many important academic issues were also discussed. The present meetings, by and large, are unable to do this.

Some wrote that monthly meetings continue to be held at some places through Eklavya's initiative even after the closure of the programme. These meetings are usually held on Sundays and several teachers attend them because they want to know and understand what they are supposed to teach from the new science textbooks. Some others wrote that we are now back with the old type of science which has no forum to discuss problems that arise during teaching. They demanded that monthly meetings and other HSTP forums be set up. These were destroyed following the HSTP closure and nothing has been set up in their place.

6.5.4 Kit materials

The general feeling about the science kit was that it was difficult to handle even though students brought a lot of materials needed for experiments on their own. Teachers felt that availability of kit was a problem during the initial years and arrangements for replacing and storing kit materials were not easy to make. However, they admitted that the replacement systems in later years had become more efficient. A few teachers said the kits were extremely simple and did not require a separate lab. A few, however, felt the whole process would have been more efficient if there was a separate science room to do experiments.

6.5.5 Classroom environment

Many teachers felt the classroom environment had changed and students were more participative. There was general agreement that the organisation of the classroom had changed. They referred to the change in seating arrangements and the role of the teacher. Some teachers, however, said the experiments and discussions made the classroom extremely noisy.

6.5.6 Teacher training

The unanimous opinion of teachers was that the trainings were meaningful and useful. Some recollected the fact that eminent scientists came and discussed science with them and they had the freedom to ask any question they wanted. They also remembered working in groups during the training and conducting experiments themselves. A few remembered the *Laghu Prashna* given and felt they learnt a lot during these trainings. Some pointed out that there was no lecture method followed in these trainings and the orientation was through experience and practice of the HSTP methodology. The orientations were serious engagements to understand concepts through experiments, analyses and logic. There was no imposition of the workbook and its content. In fact, the content was always open to critical review and analysis. Many modifications were made in the HSTP workbooks during the trainings.

6.5.6 Field trips

Several teachers felt strongly positive about the field trips and also recalled their own field trips during the trainings. They said that students had the chance to observe and interact with their environment during these excursions. They observed plants, animals, stones, flowers, fruits, etc and learned to make detailed and careful observations. They learned to ask questions of different kinds of people, recognise sources of information and widen their knowledge sources. The teachers also felt the field trips were not picnics and required serious preparations and engagements.

Some teachers, however, felt the field trips were a difficult proposition that could not be taken up as frequently as suggested in the workbooks. Some said they took students out only on one day and got them to do whatever they were supposed to do in terms of collecting material for the classroom. They mentioned constraints in taking students out in a systematic way to look for plants or animals and learn from their experience.

6.5.7 Redistribution of marks

This is one area where the majority of teachers showed minimum understanding. They carried many impressions about the exercise. Many thought it was to rationalise marks and pass a larger number of students. Some felt brilliant students lost what was their due. One said it was a confusing process that sowed doubts about the intentions of the programme's implementers as it appeared to be an exercise to adjust results. According to him it was done to basically achieve a good pass percentage. One teacher said it was a good thing because it helped students pass the examination by allotting more marks to questions they performed well in. A few said they knew nothing about it.

Only a few teachers showed an understanding of why this exercise was taken up. One said it helped in spotting errors in the question paper as well as identifying portions that may have been mis-communicated to the students. In a sense this was, therefore, an exercise to understand how students read the paper and responded to it. Using that as a base, the importance and relevance of each question was then weighed. Another teacher said the exercise allocated weightage according to the quality of questions. Good questions got more weightage and poorly framed or poor questions got less weightage. One teacher said it helped make better judgments about the students.

6.6 Qualitative report based on written responses to T-11

6.6.1 Experiments

The interviews with teachers, former and current students brought out a few interesting aspects of the HSTP. Students distinctly remembered having done experiments in their science classes. During the interviews, they made comparisons between science teaching in the higher classes and their own experience in the HSTP classes. In this way, they were able to elaborate their understanding of two different kinds of learning environments and articulate interesting experiences of the HSTP classes. Most found the HSTP classes fascinating and missed them in learning science in the higher classes.

The ability to design new experiments and models was seen as an outcome of the programme. Some of them recollected that all the experiments they did were not based on the 'science equipments' supplied in the kit to the schools. They remembered bringing a lot

of stuff from home - leaves, pulses, wheat flour, injection bottles and so on - for doing experiments.

6.6.2 Group learning

Another important point mentioned was learning from peers while conducting experiments in groups. Group activity based learning was considered a unique experience by most respondents. The important memory for them was learning from one another through interactions during the experiments and then drawing conclusions through a collective process with the whole class. Teachers, too, pointed out this unique feature of the programme and stated that it gave them an opportunity to build a more meaningful and academic relationship with each other during trainings and meetings. Former students credited this methodology for bringing richer meaning to their friendships with classmates. A few stated this by unambiguously emphasising, “The interactions among team members used to be on issues related to science and scientific methodology.”

A few students, however, did not say anything on this issue, writing that nothing happened in their classrooms - meaning no group work, no experiments and no field trips. Thus, having been denied the experience of the HSTP methodology, they were not in a position to comment on it in a positive or significant way. It, however, becomes clear from their responses that they did feel they had missed out on something important in their science classes.

6.6.3 Linkages

Generally, it was assumed that HSTP students found it difficult to adjust to non-HSTP science in the higher classes because there was no linkage in the syllabi. This had always been quoted as a major weakness of the programme. Surprisingly, none of the responses supported this point of view. In fact, to the contrary, most students said that science in higher classes should be taught the HSTP way. Meaning, if there have to be linkages, they should be in the form of continuation of the HSTP methodology in the higher classes and books should be written accordingly. They identified the change in methodology as the primary reason for the problems students face post-HSTP in the higher classes.

6.6.4 Field trips

Students recalled going on field trips and collecting samples of rocks, insects, leaves, crops, diseased plants etc and studying flora and fauna in their natural habitats. A few articulated their understanding of the advantages of organised field trips over students or teachers bringing samples to the classroom. They asserted that field trips were necessary for learning about the natural environment and in the natural environment. They were clear that this couldn’t happen by bringing samples to the classroom. However, many students were not able to go on the recommended number of field trips for a variety of reasons, ranging from a lack of interest on the part of their teachers to practical problems such as the location of the schools, large number of students, non-cooperation of the headmasters, and genuine time constraints. But even where the teacher managed one field trip, the opportunity was so unique for the students that it remained distinctly etched in their minds and they were able to recall even minute details of the experience. There were a few who recalled it as a lovely picnic rather than an academic exercise.

6.6.5 Examinations

"We were not scared of the HSTP examinations because there was no need to mug up answers," was the common refrain of students. They remembered the fun of their '*prayogik pariksha'* (practical examination) for which, sometimes, they were required to bring things from home. Their answers reflect pleasant recollections of the practical examination and the absence of any kind of fear or threat.

7. Conclusion

The present study represents Phase I of a larger comparative study that will involve data collection and analysis from an experimental and control group. We expect the number and range of in-depth ethnographic interviews to increase manifold. It should be possible to draw definitive conclusions from the Phase II study.

Phase I sought to get a feel of the HSTP in one SGK. The analysis of data as well as our interaction with people in the schools and the administration reveals that all remember their participation in the HSTP with clarity and, often, nostalgia. They see it as a major intervention in the school system that required special attention, particularly in classroom processes that demanded more meaningful work from both the teacher and the taught.

However, it is apparent that the programme functioned differently in different schools, with some of its aspects not being taken up in many schools.

By and large, both teachers and students seem to have enjoyed the classroom activities and benefited from them. Their responses were extremely positive. In schools where many of the processes were not taken up, students felt they had been deprived of an experience that would have been extremely valuable for them.

Some teachers did say they merely did what they were told to do since the HSTP was a government programme. However, most others felt the HSTP processes were qualitatively superior and that they learnt a lot from them. The strongest appreciation was for the training courses, which appear to have been enjoyed by all teachers. They missed these training camps the most. They did not refer to other interactive processes as strongly.

The performance in tests of conceptual understanding in science was average for both students and teachers. However, we have reason to believe from our other interactions with teachers that they performed better than teachers from non-HSTP schools would have. There were large variations in student performance, with former students performing better. But in the absence of any control data it is difficult to draw any unambiguous conclusions.

Both teachers and students performed poorly in questions that required them to express or explain something in words. The key factor appears to be poor language proficiency, as revealed in the Cloze test. A lot of effort is required in this area.

The tools prepared to study attitudes and conceptual understanding of science appear to be stable, providing comparatively similar measurements. However, we need to improve some questions in these tests.

Overall, the study shows that the HSTP experience was a major watershed for both teachers and students of this SGK. They remember it far more vividly than their experiences in other subjects. We also found a greater degree of independent thinking and confidence in

analysing new situations. Respondents were conscious of the need to reason and think as a part of learning and were strong advocates of working together in groups and learning from one another. This is significant since the views of people are generally dominated by the prevalent education system.

Though we have not been able to arrive at any significant conclusions regarding the overall impact of the HSTP or the reasons for its closure, it seems clear that a programme that expects democratic participation and freedom of analysis and articulation requires corresponding changes in the way systems deal with hierarchy.

8. Proposal for HSTP study (Phase II)

Background

The Phase I pilot study undertaken in the Harda SGK was a prelude to a more comprehensive analysis of the HSTP experience. Its terms of reference included developing a plan and design for this larger comparative study. Since this objective was in our minds from the very beginning, we devoted considerable time and energy to discussing and developing the framework and tools for the purpose during the initial phase itself. This chapter is an effort to flesh out the contours of this wider study and the tasks it seeks to undertake.

Why the study

Education processes are slow and take decades to establish themselves. We come across very few examples of programmes that have been sustained for long in a spirit of renewal and improvement. The HSTP is one of them. It existed for over 30 years, experiencing many highs and lows during its lifetime. A multi-faceted intervention, it touched the lives of not just students and teachers but academicians, educational researchers, administrators and teacher educators as well. It saw several generations of students passing out of schools and moving on to different professions in life.

To understand what happened during this period and how it reflected on those who interacted with the programme is an extremely complex task. Phase I was, at best, a preliminary exploration in this direction. What is now required is a more in-depth analysis of the impact of the HSTP on those who participated in it in some way or other. This would require making comparisons with corresponding categories of respondents in equivalent areas located in the same milieu.

Phase I did come up with interesting responses. But we could not make any definitive statement about the impact, or lack of it, of the HSTP because we could not benchmark the responses against data from a control area. The proposed Phase II study will, hopefully, bridge this gap.

Choosing a comparative sample

The prime concern in choosing a comparative sample is to ensure that the areas from which the sample is chosen has similar characteristics to the pilot study area. Its socio-economic, geographical, agricultural and other parameters must match. The similarity must also extend to cultural forms and other systems.

The original Hoshangabad district in which the HSTP was established has now become two separate districts, Hoshangabad and Harda. These districts have 10 SGKs excluding Harda, the SGK where the pilot study was done. Given below is a list of equivalent SGKs in neighbouring districts, prepared after discussions with knowledgeable people from these districts. Areas with unique or specific characteristics, such as a high degree of urbanisation, were excluded. So Khandwa, Itarsi and Betul blocks do not figure in the list. Broad parameters kept in mind while making the list are given in the accompanying notes.

Table 1: SGKs of Hoshangabad and Harda districts along with comparative SGKs of nearby districts:

1.	Pipariya	-	Gadarwara
2.	Bankhedi	-	Kareli
3.	(Kesla) Pathrota	-	Shahpur
4	Khirkiya	-	Harsud
5.	Seoni Malwa	-	Gotegaon
6.	Babai	-	Khategaon/Kareli
7.	Sohagpur	-	Gotegaon
8.	Hoshangabad	-	Narsinghpur
10.	Timarni	-	Nepa Nagar

Some of the issues that came up during discussions to choose comparative SGKs from adjoining districts were as follows:

- Hoshangabad district has several regions with fertile plains that favour intensive agriculture. This is not the case with the adjoining districts. The rural areas of these districts are mostly hilly. So finding a comparable SGK was not easy. It took a lot of discussion to match Pairs 1 to 7 for the purposes of the study.

- While Kareli has irrigated agriculture, it also has a national highway (Delhi-Chennai highway). That makes it different from SGKs in Hoshangabad district. However, its adjoining rural areas may have similar characteristics.
- It may not be necessary to find comparative samples for SGKs outside Hoshangabad and Harda. Control samples can be found within these SGKs themselves. They have schools in which students in Class XI and XII include both HSTP and non-HSTP students.

Who would be the respondents

As in the case of Phase I, the major respondents would be students and teachers. Students would be those who have completed three years of HSTP at the upper primary level, as well as a control sample of non-HSTP students. That means only those students in Class XII or beyond would qualify as HSTP students, depending on when we begin data collection. A second group would be Class VIII students of any year in the late ’80s who are currently in the 30-35 years age group. They would include those who have dropped out and discontinued their studies after Class VIII, X and XII. Such possible respondents will have to be traced. A third group would be HSTP teachers. Other possible sample groups could be resource teachers, resource group members and Eklavya staffers. Such respondents will have to be located only from areas where a matching control sample can found.

To summarise, the respondents would be as follows:

- Class XII students or beyond, depending on the year of study.

- Class VIII students of any year around the late ’80s. This sample would include those who quit after Class VIII, X or XII.
- HSTP teachers

Tools

A set of tools were developed and tested during Phase I. Based on the experiences of data collection and analysis of responses during this phase, the following categories of tools would be required for Phase II:

Tools for teachers:

1. Attitudes:
    a) Science questionnaire.
    b) Classroom process.
    c) Teacher-student relationship.
2. Understanding of science:
    a) Multiple choice (conceptual understanding of science).
    b) Short answers (conceptual understanding of science).
    c) Experimental science tasks (group work).
    d) Interview (oral and written).
3. Focused group discussion (FGD) on education. The issues to be discussed include:
    a) Nature of science and science teaching.
    b) Concepts of science.
    c) Social aspects of education.
    d) Pedagogy and children.

Tools for students

1. Science questionnaire/classroom process.
2. Multiple choice (conceptual understanding of science).
3. Short answers (conceptual understanding of science).
4. Comparison between subjects in Class VIII and higher classes, and favourite subject in Class VIII.
5. Student experimental tasks.
6. Focused group discussions.

Review of tools (issues to be looked into)

1. Weeding out pro-HSTP bias, if any. This bias may creep in because of familiarity to questions.
2. Modifying some tools for testing conceptual understanding of science.
3. Editing the language used to avoid misinterpretation.
4. Total number of tools, choice of tools and processes to administer them.

Other issues to be addressed

We need to document the views of educational administrators who have interacted with the HSTP. That would include their views of HSTP as well as their understanding of education, science and the functioning of the system.

We also need to look at the HSTP resource group, its capacity and strengths as well as its attitudes and conceptual understanding of science. The problem here would be of finding a comparative sample in equivalent areas and identifying the parameters that could define this control sample.

A third category that needs to be studied is HSTP resource teachers who have been associated with the programme for a long time and have made significant contributions to its evolution. This category has unique characteristics which need to be examined. These characteristics could provide guidelines for future capacity building for developing and facilitating independent innovations, textbook writing and teacher support activities.

Data collection

The data collection process will require more person-power resources. More time will also be required for data collection, tabulation and analysis. One critical element to ensure the quality of the study would be choosing the correct samples from within the SGKs and tracing potential respondents from the different categories. We would need to work on details of the process and the mechanism by which data would be collected. There are many issues that need to be worked out and several tentative ideas that need to be pursued further. Some of them are listed below:

Selecting schools for data collection for last few HSTP batches

- We will choose senior secondary schools as was done for the pilot study in Harda.
- We will randomly select five middle schools from each SGK and trace one batch of HSTP students to their villages. Most middle schools have students from 5-6 villages. The team will visit all the villages, identify and meet all students from the batch. The second set of students will be non-HSTP students.

Process of data collection

- We will first get a letter from the concerned district collector permitting us to conduct the study. The data collection team will then visit each village to identify the sample students and ensure their participation. The team will also meet teachers and village elders.

Expected timescale for study

We will need at least two years to complete the study. Data collection will take around 2-3 months. A detailed time-line is being worked out in consultation with the study team.

Study team members

Vidya Bhawan Society will constitute the core study team, with members drawn from other institutions, including Delhi University. Investigators will be hired for data collection in Pipariya/Hoshangabad.

Budget heads

The budget heads will be broadly similar to those of Phase I. They include:

1.	Coordination, planning, tool development and report writing by the coordination team	
2.	Field staff participating in tool making, pilot testing and data gathering	
3.	Travel	
4.	Boarding and lodging	
5.	Communication	
6.	Stationary, including computer consumables	
7.	Tape-recorder hiring, batteries, tapes, printing of tools	

We may include editing, printing and publishing of the report as another budget head that may be required later for the dissemination of the findings.

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