

EXAMINATIONS

Assessment in HSTP

One of the reasons why the innovative science education programme running in Bombay's municipal schools was closed down was because the municipality refused to permit any changes being made in the Board examinations. It was clear to the teachers that their students would not be evaluated for the kind of things they were learning in science because the Board examinations only ask questions about formulae and memorized information. So their students would be at a disadvantage and would suffer.

This was an important lesson from the Bombay experience. That's why when B.G. Pitre met Sudarshan Kapur and Anil Sadgopal in Rasulia with his proposal to start a science education programme in Hoshangabad, he told them that they should first get permission from the government to change the examination system before implementing the innovation. This point was mentioned in the 1972 proposal although it was not emphasized strongly enough. Anil Sadgopal puts it succinctly: "Examinations are the stumbling block of all innovations because they are a powerful weapon to maintain the status quo."

Changing the examination system was a major concern of the HSTP from the very beginning. The basic approach was that an examination should evaluate what children are taught or what they are expected to learn.

Like the HSTP's other components, the examination system was developed on the basis of field experience. So examination methods kept evolving over the innovation's 30-year lifespan, although the basic thrust remained the same.

One thing needs to be mentioned at the outset. The HSTP group was clear that the best examination would be one the teacher himself/herself conducts. That is, every teacher should have the freedom to test his/her students. The purpose of this examination would not be to pass or fail students, or place them in first/second/third class. It would be to assess how much and what the students had learned till then, which topics they were now equipped to learn, where they needed more time and support, and what more they needed to experience. This topic was discussed threadbare by the resource group and the teachers during the first phase, with the resource group constantly demanding that the teachers pay more attention to internal assessments.

Board examinations during the early days of the HSTP were held at different stages of the school cycle in Madhya Pradesh. The first examination was held in class 5 and was conducted at the district level. Next came the upper middle school Board examination (class 8) that was held at the divisional level, followed by the class 10 and 12 Board examinations that were conducted by the state-level Board of Secondary Education.

The first batch of HSTP students reached class 8 in 1974-75. At that time, Friends Rural Centre and Kishore Bharati again broached the subject of conducting its own examinations with the state government. Taking an important - and bold - decision, the government permitted the two organizations to organize and conduct the class 8 examination in the 16 HSTP schools, recognizing this examination as equivalent to a Board examination. In other words, the government had accorded two non-governmental organizations the status of an examination Board. This was an unprecedented step for any state government to take at its importance cannot be lost on anyone working in the field of school education.

So the class 8 Board examination in the 16 schools were conducted by Friends Rural Centre and Kishore Bharati from 1975 to 1980.

After the district-level expansion of the innovation, the HSTP group came out with a paper in 1977 describing the kind of examination system it had developed. This paper is given below. I have added a few points in parentheses to clarify some aspects. The paper goes into the thinking and logic behind each element in the examination system, which we shall discuss later. It also gives the learnings from the field experiences until 1977. Many of the elements were experimentally tested during these five years and we shall throw more light on these aspects. The third point is that the examination system was not adopted exactly in the form developed during the pilot 16-school phase. Several changes were made in the details. We shall discuss these as well. And finally, we shall go into the field experiences in implementing this examination system and the impact it had on the teaching-learning process.

HSTP EVALUATION – A FRAMEWORK (1977) – GIVE ORIGINAL PAPER

Summary

Briefly, the HSTP examination system had many elements that were different from the traditional examinations, which included:

1. Freedom to refer to exercise books and textbooks (open-book examination).
2. Unlimited time for the written examination.
3. Provision for holding a practical examination (post-middle school stage).
4. Group setting of question papers.
5. Consciously incorporating questions outside the curriculum.
6. Review and analysis of answer papers.
7. Not specifying marks allotted for each answer in the question paper.
8. Redistribution of marks after the examination.
9. Division of the curriculum as per examination requirements.
10. Grace marks.

11. Two question paper solving sessions with students in which they could freely seek clarifications (in the initial phase).

After the district-level expansion

Many of these elements were retained after the district level expansion and integrated into the HSTP divisional Board examination. The divisional education office published a manual on the new examination system to help the education department understand and adopt it. The manual outlined the framework of the system and its processes, giving the logic behind each element so that the government could make the required changes to internalize and standardize these processes.

Barring grace marks, unlimited time and the freedom to discuss during the written examination, the other provisions were retained. Question paper setters were given the following instruction: "The time specified for the written examination is 2.5 hours. The paper should be such that an average student can answer all the questions in 2.5 hours in a relaxed manner bereft of fear."

According to the manual, the written and practical examinations were for 60 and 40 marks respectively. To pass a student needed to score a minimum of 25% in each, with a combined percentage of 33%. The manual also stated that "the majority of questions in the two examinations should be such that the student would have to do some written and practical activities. The only difference between the two is that the written examination focuses more on theory and concepts while the practical examination tests more for experimental skills."

Practical examinations

The practical examination was retained at the district level although internal evaluations were discontinued. Actually, like in other subjects, internal evaluations (continuous evaluation) continued to be done but since they did not affect the final examination result they were taken less seriously. The practical examination tested the student's ability to perform experiments, observe what is happening and explain his/her observations.

The initial arrangement for conducting the practical examination after the district level expansion was as follows: A team of two examiners would go to each school, set the question paper together and also try to complete correcting the answer papers there itself. Each student had to do five experiments, each carrying seven marks. The remaining five marks were for the oral examination.

But there were practical and human problems in conducting examinations in this way. One problem was that the examiners often found it difficult to think up good experiments to judge the students' abilities. Also, there was no standardization of the practical examination across

schools. The teachers were also not used to correcting answer papers in the school itself, especially if they had to fail students sitting in front of them. Another problem was the pressure put on the examiner by the local school teacher to pass the students. As a result, even the teachers began questioning the objectivity of the practical examinations.

This was pointed out in a letter written by Dr Arvind Gupte to the divisional education commissioner on December 15, 1982: "Around 9,000 students sat for the 1982 divisional upper-middle school examination. Of them, around 2,400 failed in the written examination while only 19 of the regular students failed in the practical examination. Among private students, 148 failed in the written examination against 20 in the practical examination."

He concluded that "proper evaluation yardsticks were not used for the practical examination, turning it into a meaningless exercise. This laxity in conducting the examination has had a negative impact on academic standards."

Analyzing the human and academic factors behind this deterioration, the letter offers some recommendations, the main ones being that evaluation of the answer sheets should be done at the sangam kendra level and the teachers should be trained to conduct practical examinations.

When these problems began to surface, the resource group, in the typical HSTP spirit, began a dialogue with the teachers, seeking their participation, guidance and advice. The issue was discussed at the monthly meetings held in January 1983, where the teachers made their suggestions. But these suggestions were too diverse and often contradictory. For example, one suggestion was to leave the practical examination entirely to the local teachers while another was that the examiners come from as far away as possible. Some teachers felt the experiments should be selected in consultation with the teachers but others felt the paper should be set at the district level, while some wanted a readymade list of experiments from which examiners could choose (as is done at the college level). Then again, while some wanted answer papers to be corrected in the presence of the teachers, others wanted this to be done later at the sangam kendra.

Most teachers accepted that the nature and purpose of the practical examination was different from the written examination but felt it was difficult to keep track of a child's overall performance in the practical examination. That's why they felt these examinations should be conducted only when needed. But all the teachers concurred that it was the laxity in setting the question papers that was the main cause for the falling standard of practical examinations.

To summarize, the teachers' suggestions were of two kinds. There were those who felt that the practical examinations should be more decentralised to make them more effective. This would ensure proper assessment of the experimental skills of students while taking into consideration

the prevailing conditions in schools. On the other hand were the teachers who were concerned about having a standard examination of high quality for all the students.

There were cases where examiners wanted to set an experiment only to find that the chapter had not been done in the school or that the required kit materials were not available. Many times they set very simple or very difficult experiments. So the problem was to ensure that the practical examination maintained a high standard while taking into consideration the conditions in schools

Keeping this dual requirement in mind, the system was modified in 1983. Under the new system, the question paper would be set by a group of teachers at the sangam kendra level. This is how it worked. A meeting of teachers would be convened on a certain day and teachers would work in groups of 2 or 3 to formulate questions. The sangam kendra coordinator would then make sets of five questions for each school and seal them in an envelope. The envelope would be taken to the school by the examiner, who would open the envelope and conduct the examination in the concerned school. The examiner had the authority to change one question depending on the circumstances.

BOX

A 'good' question for a practical examination (from the examination manual)

“Make a good weighing balance with the wooden strip and string given to you. Don't forget to label your balance with your name and role number.”

This question helps to evaluate conceptual understanding as well as experimental skills using simple and easily available materials. Only those students who understand the principles of a balance will be able to make a good weighing balance. This means they must know it isn't enough to merely balance the weight in the two pans but that the distance of the pans from the fulcrum of the beam must be equal. If the examiner wishes, (s)he can probe this understanding further. For this each examinee could be called separately and asked to prove with the help of the weights that the balance weighs correctly.

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One other problem with practical examinations was that the examiner would often reach a school only to find that the kit needed for an experiment was not available. One way of solving this problem was to attach a kit list to each question paper and send it beforehand to all schools

in the sangam kendra to ensure that proper kit arrangements were made. One fear was that this would increase the chances of leakage of the question paper. But the experience over the years has shown that this fear was more or less baseless.

The answer papers of the students used to be assessed later at the sangam kendra. Oral evaluation was discontinued and in its place five additional marks were allotted to one of the questions. These marks were for skill and neatness and the examiner would allot them during the examination itself, noting them in the answer sheet.

This new system changed the nature of the practical examination. The main impact was that at the time of making the question paper attention had to be paid that the experiments were such that no evidence could be collected from the answer books or any other source that the children had done them.

The teachers were concerned about the kinds of experimental skills to be evaluated. Keeping this in mind, six skills covered by the curriculum were listed:

1. Measurement: Measuring distance, area and volume. Weighing things. Measuring temperature. Units of measurement. Lowest count. Approximation. Variation. Cautions and errors in measurement, etc
2. Environmental awareness: Diversity in parts of plants. Crops and diseases affecting plants. General knowledge of insects and other animals. Diversity in the living world. Soil, etc.
3. Chemicals: Separation. Acids, bases, salts and their neutralization. Gases. Chemistry skills, etc.
4. Scientific process: Observational skills. Asking meaningful questions. Making graphs. Forming groups. Mapping, etc.
5. General concepts: Magnetic effects of electricity. Volume. Reproduction. Heat. Light. Internal structure of the body. Chance and probability. Why do things float? etc.
6. Special: Making equipment with local materials. Performing experiments according to given instructions, etc.

The question paper had to have one question each for the first three skills (1, 2, 3) and one question each for at least two of the three remaining skills (4, 5, 6). Since the examiner was free to change any one question, the change would have to be for the same skill.

Written examinations

Group question paper setting: Setting question papers in a group was a practice that was retained after the district-level expansion of the HSTP. At the 16-school stage, the resource group used to set the question paper. The task was given to the teachers after the district-level expansion. This was clearly stated in the examination manual: "As far as possible, scope for

group discussions among teachers should be ensured for formulating questions and setting question papers. Experience shows that no matter how knowledgeable a person is, peer group interaction enhances his/her ability to set better questions or a better balanced question paper. So the responsibility for setting question papers for the written and practical examinations should be given to groups of at least three (if not four) teachers.”

Such a collective process raises the question of maintaining secrecy. But the teachers saw it as a progressive step and participated enthusiastically. This had a positive impact on the type of questions set and the overall quality of the question paper.

Open book examinations

Students were allowed to take the *Bal Vaigyanik* and their answer books to the examination hall. The HSTP didn't expect children to memorize information in the textbook. So they were free to refer to their textbooks and exercise books (in which they note down their observations, summarize classroom discussions and record laws, etc) during the examination. This meant they didn't have to memorize facts, terminology, experimental methods or other information for the examination. Moreover, any additional information required to answer a question was usually given along with the question.

Apart from curbing the tendency to memorize information, the idea of allowing the children to search for information required to answer a question in their text or exercise books was basically to take the fear and tension out of examinations.

The open-book system proved to be a worthy challenge for the teachers as well. The examination manual stipulates that “the questions are such that their answers cannot be directly obtained or copied from the textbook or exercise books.” That meant the question paper setter could not ask questions about terminology, laws, etc. The manual also made it clear that the “examination was to evaluate the development of skills and scientific perspective in students and their ability to use the scientific method and logical analysis to acquire knowledge. It would also evaluate how well they have understood basic scientific concepts and how sensitive they are towards their environment. That's why the hope was that “the questions would be such that they judge the children's observational and analytical abilities, experimental skills, curiosity, creativity and conceptual clarity.”

But many questions were raised about open-book examinations, mainly by parents. Their fear was that allowing the children to consult their books would encourage them to copy. They felt that was the only use that could be made of the textbook. After all, examinations were mainly to test mental retention and memorized answers. So if the textbook was in front of the child then what was the purpose of the examination?

When parents were told that no questions from the textbook would be asked (so there would be no scope for copying answers) they were only confused further. What was the purpose of allowing textbooks for examinations if the answers cannot be found in them, they asked? Shouldn't the textbooks have all the answers? They couldn't understand a process where textbooks were referred to in order to construct the proper answers.

This perception of the textbook was strongly entrenched in the minds of the teachers and children as well. Not much attention had been paid during the HSTP teacher training camps to inform the teachers about what purpose a textbook serves and how it is to be used. So they too felt that the only purpose it can serve in an examination is to copy from and the students would waste too much time searching for the answers. As for the children, they also believed the textbook should contain answers to all the questions.

It wasn't as if examination-related issues were not discussed during the teacher trainings. They were given adequate space but using textbooks during examinations was never discussed in any depth. So while the teachers may have accepted the concept of an open-book examination there was no clear understanding of how exactly the textbook was to be used (except for memorizing its information). As a result, full advantage could not be taken of the innovation.

Open-book examinations led to another problem. 'Preparing for examinations' normally meant going through the textbook and revising the answers to the questions it contained. If the children were allowed to refer to their books during the examination then what does 'preparing for the examination' mean? Parents were not too happy with the situation, although the children liked the change.

The reactions suggest that the open-book approach forced people to look with new eyes at the concept of examinations. It also reduced pre-examination jitters and tension levels, which made the children happy. They remember the practical examinations as a kind of holiday, a fact highlighted by the pilot study conducted after the HSTP was shut down.

Examinations in all three classes

The examination manual states that topics from class 6 and 7 can also be asked in the class 8 Board examination. This tended to upset both the teachers and parents. The general attitude was that once a topic figures in an examination, it should not be taken up again – because you have the right to forget everything once the examination is over. People also felt that allowing questions on the content of all three classes in the class 8 examination puts too much of a burden on the children. The examination manual provides the following justification”

This fear has no basis because the examination tests for only those qualities that should develop and be internalized if a student performs experiments or goes a field trip in the

proper manner. For example, if a student is taught to make detailed observations, (s)he will be able to use this ability in any situation, even if it is outside the curriculum. If a question seeks to test the observational powers of a student it doesn't matter which class curriculum the question is taken from. In the same way if a student learns how to plot graphs (s)he should face no problem whether the data for plotting the graph is taken from class 6 or class 7, or even from outside the curriculum. Questions can be asked in the class 8 Board examination on fundamental concepts covered in class 6 and class 7. For example, if a student has learned to group things on the basis of common properties then (s)he can be asked to group any random item to assess whether (s)he has grasped the concept of grouping. There are some scientific concepts such as grouping, measurement, variation, least count etc that are relevant in all scientific processes and at all levels of the science curriculum and without understanding them a student cannot claim to have learned science. So the rule is that in the class 8 Board examination, questions will be asked only about fundamental concepts in class 6 and class 7 and not on every topic covered in these classes.

There are some other concepts that are sweeping in their range and complexity. Among these are the last two concepts listed in the earlier chapter on the curriculum (diversity in the living world and chance and probability – see page 43). The students are not expected to understand such concepts in their totality, the only expectation being that they begin to understand and use them. The question paper setters are sensitized to this fact, which has already been discussed from the point of view of examinations in the curriculum chapter.

BOX

An example from the examination manual of a good question for the written examination

Class 6 has a chapter on 'Separation'. In this chapter children learn the different ways to separate substances contained in a mixture. Many different kinds of questions are asked on this topic in the mainstream examinations, as seen in the following examples:

1. Describe at least three different methods for separating substances.
2. Explain the following terms – sublimation, chromatography, distillation.
3. How would you separate a mixture of camphor and ammonium chloride?

These three questions can only be answered by students who have previous knowledge about the topic. They do not assess the experimental skills or scientific perspective of a student or his/her understanding of the theoretical aspects of separation. A student who remembers some facts about the topic (regardless of whether (s)he understands them or not) will be able to score well in answering these questions. Such questions will not be asked in the HSTP examination.

Now have a look at a question on separation that complies with the HSTP objectives:

Some information about four substances is given in the table below:

Substance	Soluble in water?	Sublimation occurs or not?
Ammonium chloride	Yes	Yes
Camphor	No	No
Salt	Yes	No
Sand	No	No

a) How will you separate a mixture of camphor and ammonium chloride?

b) How will you separate a mixture of camphor, ammonium chloride, salt and sand?

The question contains information about the solubility in water and sublimation of the four substances. The student is expected to use this information to think of ways to separate these substances in the mixture. The question tests the student's ability to analyze logically and only indirectly tests his/her understanding of separation. If the student has more or less forgotten the separation methods, (s)he can still answer the question on the basis of logic, reasoning and analysis if (s)he has performed the experiment.

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Minimum expectations

The minimum expectation to pass the examination was that students understood the following basic concepts:

1. Forming groups and sub-groups.

2. Measuring distance, area, volume and mass. Measuring units, expressing them in decimals, least count, errors in measurement, variation, approximation, average and mean.
3. Coordinates and drawing maps.
4. Making tables, bar diagrams and graphs, understanding them and drawing conclusions from them.
5. Making provisions for comparison in experiments.
6. Skill to conduct general experiments and chemical experiments.
7. Ability to make equipment from locally available materials.

A third of the question paper was devoted to evaluating these minimum expectations, with a third (20) of the total marks allotted to them.

The nature of questions

Two points about the nature of questions have already been made – that they are not based on memorized information nor can their answers be copied from the textbook or exercise book.

Apart from this, question paper setters were expected to keep in mind the linkages and sequence of the content across all the three classes. They were also expected to include some questions that had no direct link to the topics covered in the syllabus but test the students' understanding of some basic scientific concepts. The only caution was that they should bear in mind that whatever they ask wasn't beyond the grasp and understanding of an average student.

They were also expected to formulate questions that may have more than one possible 'correct' answer to assess the creativity and special talents of students.

Question paper setting process

A meeting of 30-40 teachers would be convened every December-January, with Kishore Bharati/Eklavya staff and other resource persons also attending. A few new teachers would be added to the group every year. The teachers would first review the previous year's question paper. Each question would be vetted to see if it complied with the HSTP objectives. The overall balance in the paper would also be assessed. The aim of the exercise was to pick out the positive as well as negative aspects of the question paper and move one step ahead. It was also to familiarize new teachers joining the process with the overall objectives of the HSTP examination and the nature of questions to be asked. Sometimes the performance of students in different questions was also analysed.

Next the group would study and discuss the examination manual to familiarize everyone with the purpose and methods of evaluation. The issues discussed included 'basic facts', 'minimum expectations' and what constitutes a balanced question paper.

After this, the teachers would be divided into groups of 4-5 and each group was expected to formulate a question paper. It normally took around two days to finalize the question papers. The marks for each question would be specified, along with instructions for evaluating their answers. (These marks allotted were indicative marks that used to be reviewed and reformulated after the examination using a statistical method). The question papers and the evaluation criteria would be sealed in separate envelopes and handed over to the district education office. The question paper of each group was kept separate.

After this, the district education officer would call a moderator - normally a teacher/lecturer from a secondary/higher secondary school who was part of the HSTP resource or organizational group. The moderator would be given 5-6 question papers. His/her job was to prepare a set of three question papers. (S)he could choose any three of the submitted question papers, or combine questions from one or more question papers to make new question papers. His/her major responsibility was to ensure that the question papers covered the basic facts, minimum expectations and a major portion of the curriculum in a balanced manner.

The three question papers made by the moderator, along with the evaluation criteria, would then be sealed in three envelopes and again handed over to the district education officer who would, without examining them, allot one for the main Board examination and one for the pre-Board examination. The third question paper was kept secure for emergency situations.

The next step was printing the question paper. The demand for secrecy meant that the question paper should not fall into the hands of anyone who could misuse it before the examination. Hence the proof reading and other jobs had to be done by the printers themselves. As a result some mistakes were inevitably committed at this stage. For example, the printer once reduced the size of a diagram in a question linked to area measurement, leading to changes in all the answers. But there was a system to address such problems. We shall now discuss this procedure.

Redistribution of marks

There are two aspects to the process of redistributing marks. The first is reviewing the question paper on the basis of the answers given by students and then preparing fresh evaluation criteria on the basis of this review. In a way this process acknowledged the fact that no matter how carefully or with how much effort one formulated questions and prepared a question paper, there would always be shortcomings and scope for improvement. The way the children answered the questions could be seen as a comment on the question paper.

If this review process is conducted well and with care it can become a valid basis for curricular and methodological reform.

There are two problems with question papers. First is the way a question is posed. Possibly, because of the language or diagrams used the child is unable to understand the question the way the question setter wants. Or there can be more than one possible answer to the question. The children's answers will then be different from the expected. In a mainstream examination, these 'different' answers will be marked 'wrong', without considering the possibility that they may be just as logical, given the way the question is posed. If this is the case, these answers should also qualify as right. The advantage with this approach is that one can ask open-ended questions or questions with more than one possible answer.

The second problem is that the question paper setter may have misjudged the difficulty level of the question, it turning out to be either too difficult or too easy. Both situations are problematic. As mentioned earlier, the objective of the HSTP examination was twofold: first was to evaluate the minimum level of understanding of the stipulated curriculum and second was to assess the relative abilities of the children. A question that was too difficult or too simple would not serve this purpose. That's why it was necessary to reallocate the marks allotted for the question.

When setting the question paper, marks were allotted for each answer but they were not indicated in the question paper. So the children had no clue of the relative importance (from the marks point of view) of each question while taking the examination. There were two reasons for not indicating the marks. First, this information was of no use to the student, although some teachers felt that the children should know the marks weightage since they could then decide which answer should be how long. This was a wrong assumption because the effort required to answer a question was not linked to how long the answer was.

The second reason was that the children had to answer all the questions in the HSTP examination. So, eventually, it didn't make a difference which question was answered in the hope of scoring marks.

One other reason for not indicating the marks for answers was the possibility of redistributing the marks after reviewing the answer papers so allotting marks beforehand was unnecessary.

A summarized description of the renormalization (redistribution of marks) process follows:

Before the examination is held, around 500 roll numbers of students appearing for the examination are randomly selected and sent to the examination centres. The selected sample is about 5% of the total number of students sitting for the examination (around 10,000). Each centre picks out the answer books of all the randomly selected students appearing at that centre, seals them in an envelope, which is dispatched to the district education office.

Groups of 2-3 teachers then evaluate each of the randomly selected answer papers at a 'marks renormalization' workshop, first allotting marks as per the pre-determined allocations. These marks are noted down on a sheet of paper and not on the answer paper because they are not the final but temporary marks.

The evaluating groups also pinpoint all the answers given by the children that are not the correct answer. These 'wrong' answers are reviewed to see whether the children may not have understood the question correctly because of lack of clarity in the language, presentation or any other aspect.

This analysis provides feedback on the curriculum and textbook as well as the teaching methodology, so the process can be looked at as an attempt to add a new dimension – feedback collection - to examinations.

The allotted marks are totalled and the answer papers are arranged in descending order of the marks obtained.

Now comes the statistical calculation. The answer papers are divided into three equal lots, with lot 1 being the highest scoring students, lot 2 the in-between students and lot 3 the lowest scoring students. Lot 3 is set aside during the next procedure.

The total allotted marks for each question in lots 1 and 2 are compared and two indices are calculated – the facility index and the discriminant index.

The facility index indicates the average marks scored for the question - if one mark is allotted for a question, how much each student scored on average. The facility index falls between 0 and 1. If no student answers the question the index would be 0 and if all the students answer it would be 1. In a way the index judges the difficulty level of the question; the higher the index, the easier it is.

The discriminant index shows the average difference between two groups of students. This indicator also ranges from 0 to 1. If 1 mark is allotted to a question and if one group of students scores 1 and a second group scores 0, then the discriminant index is 1. If both groups score the same marks the index is 0. The index shows how good the question is in differentiating between the children; the higher the index, the greater the differentiation. (Theoretically this indicator could also be negative but it has never been so in the many years it was used.)

What we require in a question paper is that i) a question is neither too easy nor too difficult, and 2) the question can differentiate better between better and weaker students. For this, a balance must be achieved between the facility index and the discriminant index. To achieve this balance, a combined indicator called the quality coefficient is calculated.

$$\text{Quality coefficient } (\alpha_x) = F_x D_x (1 - F_x)$$

The quality coefficient shows where the question figures in relation to the facility and discriminant indices. The redistribution coefficient of the question is then obtained by the following method:

$$\text{Redistribution coefficient } W_x = \alpha_x \times \text{marks allotted for Q No X}$$

The weightage of all the questions is calculated in this way. However, all questions about basic concepts that constitute minimum learning expectations are excluded from the calculation. Once the weightage is determined, the marks for each question are redistributed using the following formula:

$$M_x = W_x \times M_t / \Sigma W$$

where M_x is the redistributed marks of Question X, W_x is the redistribution coefficient, M_t is the total allotted marks for all the questions (excluding the minimum learning expectations questions) and ΣW is the total of the redistribution coefficient of all the questions.

This process may appear a bit complicated but most teachers learned to do the task with a fair degree of competence.

But the process did give rise to many misconceptions about the HSTP examination system. Critics accused the HSTP examiners of discarding difficult questions to improve the overall examination result. They also felt that the brighter students who could answer the more difficult questions were placed at a disadvantage. Many felt it was undesirable to carry out such exercises once the examination was over because that would tend to dilute its seriousness. But much of the criticism can be seen as arising from ignorance of exactly how the process works. After all, most of the teachers who participated in the process saw it as highly useful and transparent.

The nature of questions

A closer look at the nature of questions (especially in the written examinations) is required if one is to fully appreciate the theoretical framework of redistributing marks. Are they suited to judge the objectives of the HSTP? Is the spirit of innovation evident in designing questions?

Question paper setting was one of the most difficult challenges in the HSTP so whatever was attempted should be seen in this light.

We had pointed out earlier that resource persons from Kishore Bharati and Friends Rural Centre conducted the examinations during the 16-school phase. Most of them were university teachers or research scientists. They were knowledgeable in their subject area and understood the links

between the different concepts. After the district-level expansion, the middle school teachers took over the process of setting question papers. Inevitably there were qualitative differences between the questions formulated during the first phase (1972-74) and the district level phase (1975 to 1980).

There is no denying that the teachers did make sincere efforts to set questions that complied with the HSTP objectives. Between 1981 and 2002, 22 final examinations (and as many term examinations) were conducted in Hoshangabad district alone. Apart from this, annual examinations were also conducted in Indore and Ujjain divisions (1986-2002) and Harda district (following its bifurcation from Hoshangabad district). If the questions set during this period are analysed, one astonishing fact emerges: barring a couple of exceptions, no question was ever repeated. The teachers maintained the pressure to formulate new questions year after year.

It is also evident that they made every effort to judge conceptual understanding and skill development of the children. In fact, educationists would benefit if the HSTP question papers are published and distributed. Some examples are given below:

Some questions asked in the examinations

The HSTP took great care to ensure that the questions were not memory based nor did they seek to extract information. But carrying this out in practice was a difficult challenge that tested the creativity of the question paper setters. Many commendable efforts made. We shall discuss some examples to see the basic differences between the HSTP examination and the mainstream Board examination.

1. April 1976 (class 6)

What are the properties you would look for if you wanted to find the differences between two wheat plants? (Some plants are displayed in the examination hall. You may look at them if you wish.)

2. April 1976 (class 8)

- a) You have done a copper plating experiment using an electric current. How would you coat an iron vessel with copper? Draw a diagram to explain the process.
- b) Can this method be used to copper plate an earthen vessel? Yes/No.
Give reasons for your answer.

3. April 1976 (class 8)

Read experiment 1 in the chapter 'Looking at the Sky'. In this experiment, a rod is planted vertically in the ground and pegs are fixed at half-hour intervals on the tip of its moving shadow. A boy from Hoshangabad performed this experiment and drew a line to join all the pegs. The line looked like the one drawn below. In this diagram, the timings of only two pegs are specified – 1.00 pm and 2.00 pm. Now answer the following questions:

(Diagram)

- i) Where was the rod planted? Indicate the spot in the diagram.
- ii) The line has three points a, b and c marked on it. At which of the three points would the 3.00 pm peg be?
- iii) Indicate the east and west directions in the diagram.
- iv) Indicate the north and south directions in the diagram.
- v) Can you tell by looking at the diagram in which season the experiment was done?

4. 1975

Design an experiment to find out whether sunlight is needed/not needed for seeds to germinate.

5. 1974

Suggest an experiment to prove that the air you breathe out and the gas produced by a burning candle both contain carbon dioxide. Draw a diagram of the experimental set-up.

6. Two groups are given four substances each. The properties of these substances are listed in the table below:

Substance	Dissolves in water?	Magnetic or not?	Melts easily?
Iron filings	No	Yes	No
Wax	No	No	Yes
Sugar	Yes	No	No
Lac	No	No	Yes

One group chose a substance and the other asked the following questions to find out what the substance was:

1. Is the substance soluble? Answer: No
2. Is it magnetic? Answer: No
3. Is it white? Answer: No

- a) What is the substance?
- b) Can you formulate better questions so that you can get the correct answer by asking fewer questions? Write the questions in the blanks below:

7. Hoshangabad annual examination 1996.

Mahesh heated water in two buckets. He placed some apparatus in the buckets in the way shown in the diagrams below. Answer the following questions:

(diagram)

- i) In which bucket will the water be heated quicker?
- ii) Why does the water in that bucket heat faster?
- iii) How is heat transferred in this case?

(This question was discarded because a review of the question showed that most of the children were unfamiliar with the 'apparatus' and so could not answer correctly.)

8. Diagrams of several houses are given below. In each diagram draw a line passing through all the doors of the house without going through any door twice (as shown in the diagram in the centre). Mark those diagrams where it is not possible to draw the line with an x. Make a new door in these cases to make it possible.

9. Hoshangabad 1985.

Satta is a game played with money. The players choose one among 10 numbers – 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 - and bet money on it. If that number falls, they win.

What are the chances of a satta player winning?

If satta is played with two numbers then the total numbers would be 00, 01, 02 98, 99.

A player can bet on any pair of numbers and wins if that pair falls.

What are the chances of a satta player winning with pairs of numbers?

On the basis of your observations, can a player lose or gain from playing satta?

This last question, linked to the children's social environment, was raised in the state assembly (Vidhan Sabha) where it was alleged that the HSTP was teaching students to play satta. This was a rare instance of such a debate on an educational issue taking place in the state assembly.

But not many such questions linked to the social environment were asked in the class 6 and 7 examinations conducted at the school level. This could be because except for a small percentage, many of the teachers had not participated in question paper setting for the Board examinations so they could not benefit from the discussions that took place during these exercises. These teachers usually stuck to formulating the more traditional type of questions for the school examinations.

But why didn't the questions asked in the Board examinations influence or put pressure on the other teachers? This is something that needs looking into. One reason could be lack of resources. There is little scope for using diagrams and other materials for local examinations because the question papers are not printed. Another reason could be that it was not possible to orient the teachers into this way of thinking on a large scale.

Teachers from many sangam kendras did try to address this problem and came up with a new initiative. They got together and decided to prepare a single question paper for all the 50-60 schools in the sangam kendra complex. This provided the opportunity for the resource teachers to work with the other teachers to prepare 'good' questions. A second advantage was that the question paper could be printed, because it served a larger number of schools. Once this system was implemented some improvement could be seen, yet one other problem remained.

The education administration played no part in this process of preparing joint question papers at the sangam kendra level. So it was an effort coordinated solely by the teachers. A school could opt to join it or not. But wherever the attempt was made, all the schools in the sangam kendra did join in. The only remaining difficulty was that the teachers had to find the time and spend extra hours to do this work in the absence of official permission.

Impact on teaching/learning

One aspect about the question papers that the teachers did not like was that they did not favour objective-type assessments. They demanded this type of assessment that comes with clear-cut instructions on how marks are to be allotted. As a result there was less space for open-ended questions or questions with more than one possible correct answer so their number became fewer. The proportion of questions requiring children to write explanations also decreased because assessing such answers gave more scope for 'subjectivity'. Such changes are perhaps inevitable when such a system is scaled up to a macro level.

One other consequence was that more questions began to be asked from the chapters that were amenable to objective type questions-answers and left no scope for ambiguity in assessment.

The skewed representation of chapters can be seen in a review of question papers set between 1982 and 2002. Some chapters featured regularly every year, while some others were almost totally overlooked. It wasn't just the chapters. Even different concepts, elements of the scientific method and experimental skills began to get less and less attention in question paper setting.

Chapters from which questions were asked almost every year:

1. Measurement
2. Coordinates
3. Graphs

4. Decimals
5. Electricity
6. Bar diagrams/Probability
7. Time and Pendulum
8. Acids, bases and salts
9. Relative density
- 10 Structure of human body (after 1987)

The minimum learning expectations of the HSTP feature in four of these chapters. Among the chapters that tended to be neglected were the following:

1. Living world through the microscope
2. Sound
3. Heat
4. Reproduction
5. Gases
6. Living and non-living
7. Looking at the Sky
8. Light
9. Soil

It is not as if no questions were asked from these chapters, but their proportion fell. If seen in terms of numbers then more than half the questions were from the following chapters:

1. Measurement	98 (minimum learning expectations)
2. Coordinates	68 (minimum learning expectations)
3. Graphs	88 (minimum learning expectations)
4. Bar diagrams	89
5. Acids, bases and salts	55
6. Relative density	69

This distribution is seen in a survey of question papers covering 15 years (for which the question papers and the allocated marks are available). The total marks for the 15 years were 900 (60 x 15) and the above 6 topics accounted for 467 marks (51%).

Other chapters that have more or less adequate representation include:

1. Decimals	36 (minimum learning expectations)
2. Classification, grouping	33 (minimum learning expectations)
3. Electricity	48
4. Pendulum	32
5. True/false	35

6. Life cycle of animals	45
7. Structure of the human body	33

Among these, the last two (Lifecycle of animals, Structure of the human body) began to find a place after 1987.

The question paper review exercise carried out in 1986 showed that almost no questions were being asked from some chapters so many teachers had stopped teaching these chapters. Among these were the biology chapters, whose representation in the survey cited above was as follows:

1. Environment, general observations	11
2. Agricultural crops	22
3. Reproduction in flowers, plants	8
4. Life cycle of animals	33
5. Structure of the human body	45
6. Growth, development	12
7. Living and non-living	22

These chapters accounted for 153 (17%) of the 900 marks. This is the situation even after questions began to be asked almost every year after 1987 from the two chapters 'Lifecycle of animals' and 'Structure of the human body'.

The situation until 1986 was as follows:

Graphs	29
Measurement	27
Relative density	22
Bar diagrams	21
Acids, bases and salts	20
Coordinates	19
Environment/observations	11
Pendulum	9
Flowers/reproduction	7
Crops	5
Soil	2
Life cycle of animals	0
Structure of the human body	0
Growth, development	0
Living and non-living	0

If we look at the questions in terms of 'curricular objectives', a 1976 discussion reveals that the class 8 examination was limited to assessing the 'ability to understand and explain in simple words with the help of diagrams, ability to find answers to simple questions through the discovery method, and the topics and concepts in the chapters (such as acidity, magnetic repulsion etc).

This imbalance raised questions about assessing learning outcomes through examinations. The first question was: what effect did it have on teaching/learning? There is no organized information available on this aspect but if we accept what the teachers have often said, they understood the situation well and modified their teaching strategies accordingly.

For example, when teachers at the Piparia meeting were asked whether the examinations had any impact on teaching in schools, they replied in the affirmative, saying the impact was significant. The chapters considered important from the examination point of view included 'Graphs of motion', 'Grouping', 'Acids, bases and salts', 'Why do things float?', 'Time and the pendulum', 'Chance and probability', etc. The chapters that were neglected or overlooked because they seldom figured in the examinations included 'Looking at the Sky', 'Machines', 'The living world through a microscope', 'Classification', 'Electricity', 'Growth', and 'Development'.

Why did this happen? Was it a consequence of the limited creative abilities of the question paper setters? Or was it because an examination cannot assess understanding of some concepts or judge skills and abilities? Did this mean the HSTP written and practical examinations were inadequate and needed another dimension added to them?

Take the example of the biology chapters. They encouraged children to study the animals and plants, fruits and flowers, insects, crops and crop diseases in their immediate environment. In the process they developed study skills and methods and were sensitized to their environment. They also learned how to learn on their own. How would a written examination test these aspects?

Similarly, the chapter 'Structure of the human body' taught children how to recognize the different bones in their body, understand how the joints work, and build up a mental picture of the body and its different organs. The same was the case with chapters like 'Lifecycle of animals', 'Growth', 'Development', 'Reproduction', etc. How was sensitivity towards the environment to be assessed?

The attempt in all these chapters was to develop in children's minds an understanding of their milieu and to familiarize them with methods to study the environment. Such an understanding cannot be universal, nor can the methods. So if one sees the HSTP examinations from the angle of conceptual understanding, they were not practicable, despite the innovative efforts put into them. Children were generally asked questions to which there could be only one correct answer

so that an evaluation could be made. So even if the HSTP examination provided greater scope for open-ended questions - and such questions were set from time to time – compared to the mainstream examinations, it was still not particularly well suited to assess conceptual understanding or mental imagery. It demands more creativity to find a fitting answer to this problem.

This problem had an interesting outcome. When pressure on the teachers increased to set questions from as many chapters as possible, they began setting questions from two particular chapters – ‘Lifecycle of animals’ and ‘Structure of the human body’. All the question papers set after 1987 contain questions from these chapters, but most of them were formulated by merely tinkering a bit with the questions in the 1987 paper.

Another point to be noted is that even if some chapters predominated in question paper setting, as we have seen earlier, a closer look at the questions reveal that most of them were basically numerical in nature. This wasn't a problem in the case of mathematical concepts like measurement, coordinates and graphs but even in the case of concepts like chance and probability, acids, bases and salts and relative density, the focus of the questions were on the numerical aspects rather than conceptual understanding.

It is evident that the chapters that were favoured were more amenable to formulation of objective-type questions or questions that made assessment straightforward and unambiguous. For example, in ‘Acids, bases and salts’ the question would usually have a table giving the effect of indicators on a list of different substances and asking the children to identify which are acids or bases. Or it would be a question involving calculations, which were more popular. Similarly, the ‘Chance and probability’ chapter is based on an abstract concept that the children were not expected to grasp in its totality. But very few questions were set on this abstract concept. Instead, there was an abundance of questions on drawing bar diagrams of given statistics, finding the mean, finding the average etc.

Another interesting observation is that whenever a conceptual question was asked, it would usually be structured in sequential manner. Some figures would be given for each step. Finally, when it came to applying the concept some more figures would be given.

In sum, it can be said that the HSTP did develop a totally new examination method in which it basically preferred the children to be assessed by the teachers themselves. Efforts were made to free the children from the tension of examinations by introducing open book examinations and giving them unlimited time to answer (at least in the initial phase). But the Board examination was a necessity of the mainstream that could not be avoided. Keeping in mind the existing reality, the HSTP was yet able to introduce systems for question paper setting by groups of teachers, reviewing question papers after the examination and redistributing the allotted marks

for each question. In addition, the HSTP did manage to give greater emphasis to testing experimental skills in the children with its provision for conducting practical examinations.

The teachers were instructed not to formulate questions that tested the children for memorized information or whose answers could be copied directly from the textbook. Setting an HSTP question paper thus became a challenge for them and they responded in a concrete way, making every attempt to set questions that evaluated the conceptual understanding of children. Most important, the teachers tried to ensure that questions were not repeated over the years and this is reflected in the question papers set in the 25-odd years following the district level expansion.

One positive outcome was that the fear of examinations was considerably reduced. This was mainly because the children were free to consult their textbooks and notebooks during the examinations. In actual practice, children did not make much use of this option but the fact that the textbook was beside them had a striking mental impact.

Teachers also changed in the way they looked at examinations. Setting question papers in groups and reviewing them after the examinations were processes that gave them with a new platform for educational dialogues and discussion. The transparency of the process also dealt a blow to the hyped-up secrecy and mystery surrounding examinations.

But the HSTP examination could not breach all the well-entrenched barriers. So even though it gave more scope for open ended questions the teachers continued to hesitate to formulate such questions, the answers to which were more difficult to evaluate. As a result many important concepts got less space in examinations. Similarly, the HSTP examination manual states that evaluation should assess whether the children have developed the ability to ask meaningful questions, were encouraged to give alternative explanations, or were more open to accept dissenting opinions, etc. Such concerns found no place in the examinations.

An analysis of question papers shows a tendency to favour quantitative concepts. Qualitative concepts got relatively less space, while open ended questions and more involved questions were almost totally neglected. Making such questions for 10,000 children was perhaps not possible. So it appears that most questions were of the type that could be assessed by the teachers at the school level. And if evaluation is not possible with a single question, perhaps there should be provision for asking alternative questions. In other words, there should be provision for an oral examination.

Another shortcoming was that despite so much effort and capital being put into the Board examinations, the local examinations continued to be dominated by traditional-style questions. This was a matter of concern for the resource persons who tried to organize local examinations at the sangam kendra level in the 1990s in order to improve their standards of question paper setting. Several sangam kendras did take up the task, duplicating the process introduced for the

Board examinations, minus the reviewing of question papers and redistributing of marks. It was the teachers themselves who spearheaded the initiative at the sangam kendra, without seeking help from the education administration.

In this way, the HSTP sought to affect concrete changes in many administrative aspects of conducting examinations and also put in a lot of work in breaking down obstacles that inhibited the creativity of the teachers. But a lot more remained to be done and there was a lot of scope to do more. So even if far-reaching innovations were made in examinations by the HSTP, several questions still remain to be answered.

The most important question is whether the HSTP examination succeeds in fulfilling a new role or whether it continues to play the same pass-fail role of traditional examinations. The question also arises whether fundamental changes are at all possible in a highly centralized examination. In the beginning there was strong emphasis on internal evaluation of the children by the teacher. Perhaps, the HSTP group would have happily conferred the entire responsibility of evaluation on the teachers. But experience shows that the teachers were themselves against such an idea. The centralization of the practical examination was also the result of their demands. In such a situation, to what extent is innovation in examinations possible?

If we accept the need for a centralized examination, the question that then arises is what kind of questions can be asked in such an examination? What type of questions could serve to evaluate what children have learned? The HSTP experience with examinations shows that there are several obstacles in formulating such questions in a centralized examination. The reason is because you can only ask the kind of questions that require written answers that can be easily evaluated.