CHAPTER IV

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CHAPTER IV

PROGRAMME FOR PROBLEM SOLVING APPROACH

4.1 INTRODUCTION

There is a nice saying "Plan your duties and save your life." Planning is the key to success. The present human generation is more active in a scientific way of planning. Planning saves labour and time. Unplanned work will never yield better results and consequently brings frustration. While planning, the planner has to look at the achievement, activities tools and the obstacles coming against the procedure. Planning involves pre-viewing and reviewing of any sort of activity, arrangement of all details thinking about the various devices for the implementations. Planning gives economy of labour and time.

So, here in this chapter the investigator tries for planning, construction and tryout for problem solving approach.
4.2 PLANNING FOR PPSA

Some existing works regarding problem solving were referred to as reviewed in the previous chapter with an intention to prepare the base for the various types of problems in various school subjects.

There are two broad accepted approaches of teaching problem solving.

(1) Problem solving in group.
(2) Problem solving individually.

In this study second method is applied. Students have to solve problems individually.

After referring some reference books of various types of problems, investigator decided a structure to construct some problems according to the level of Std. IX pupils. Planning for preparing problems, involves the following school subjects.

(i) Problems related to Mathematics,
(ii) Problems related to Science,
(iii) Problems related to Gujarati language,
(iv) Problems related to Social science.

Students of Std. IX are partly conversant with some problems of above subjects. They can understand some problems of mathematics and science too. So researcher has selected these two subjects. In addition to these two
subjects, the subjects of language and social science are also selected to investigate their effects.

Time factor is also noted in the planning for construction and tryout of the selected problems. At the time of planning and framing the language of the problems and their effects the responses of the students were considered.

The selection of the problems for above subjects was considered after discussion with experts and teachers working in the academic field and teaching in secondary school.

Nunnally suggested to construct three times more items for the preliminary tryout. According to this suggestion investigator has selected and constructed round about hundred problems for finding their effects. Problems were divided into two parts (i) Mathematical problems and (ii) Non-Mathematical problems.

Problems of Gujarati language, social science and science were considered as non-mathematical problems.

In planning, the strength of the students to tryout the problems was considered. 10 students for pre-pilot and 20 students for pilot try out were taken. The planning of two month period was done to tryout the problem solving approach. One month out of the two was for oral testing to

understand the language of the problems. Researcher had planned to note the responses of the student for each problem.

J.P. Guilford has suggested to provide minimum one month's training to get significant change in creativity of students. According to E.P. Torrance at least two month's training is necessary for a definite change in a creative level of any person. Such different views of the scientists were taken into consideration for the development of the training programme under reference.

Investigator has provided good atmosphere to the students to give the answers of the problems. Special arrangement for classroom and stop watches were given, so that the students can give the proper answers of the problems. Each student has facility to note the time for solving each problem.

Out of hundred problems, forty problems were considered for the training programme.

The present study was not an ability test but a training programme, because the final form of the problems was going to be used for training note for testing. So investigator had selected 40 problems for mathematics, 20 items each for language, science and social science. For pre and pilot tryout researcher has arranged written copies
of the problems. The number of problems to be included in the final form is expected and shown in the following table.

TABLE 4.1
SUBJECTWISE NUMBER OF PROBLEMS FOR FINAL FORM

<table>
<thead>
<tr>
<th>SR. NO.</th>
<th>CONTENTS</th>
<th>FINAL FORM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mathematics</td>
<td>16</td>
</tr>
<tr>
<td>2.</td>
<td>Science</td>
<td>8</td>
</tr>
<tr>
<td>3.</td>
<td>Gujarati language</td>
<td>8</td>
</tr>
<tr>
<td>4.</td>
<td>Social Science</td>
<td>8</td>
</tr>
</tbody>
</table>

A special answer book for solving the problem was given to each student. In this answer book they have to write their name, sex, school name and class.

In planning, tressing papers and pencils were also provided to each student. The help of other teachers was taken in this task.

4.3 CONSTRUCTION OF PPSA

Keeping in view the requirement of the problems in final form, it was decided to construct two and half times more problems in the beginning. Researcher has decided to construct mathematical and non-mathematical problems. It will be useful to discuss the construction of the problems
in the following parts.

2. Construction of Science problems.

4.3.1 **Construction of Mathematical Problems**

As mentioned above 40 problems of this subject were prepared in the initial stage. Two branches of school mathematics i.e. arithmetic and geometry were included in this type of problems. Alongwith this some problems of general reasoning of mathematics are also included. While constructing these types of problems, the thinking level of Std. IX was also considered.

Some special types of problems are also constructed in which students have to use tressing paper to find out the correct solution.

**Ex.1-Problem-9.**

  . . . .
  By joining proper four points, a square can be prepared. Now join four points and prepare highest number of square, using tressing paper.

**Problem-14** is also constructed in which students have to use tressing paper to find out the correct solution.
Problem-14
How many squares are there in the figure? Show your number of squares by using tressing paper, separately.

Fig. 1

Some interesting problems of arithmetic are also constructed in which students have to calculate for the solution of the problems with fun. Problem 8 is of this type.

Problem-8. When people did not know more about mathematics, they used a 'counting-state' to represent the figures.

For example 1917 is shown as under.

```
* * * * *
* * * * *
```

Fig. 2

Now, find out the hidden secret in this, and find out the hidden figure from under given slate.

```
* * * * *
* * * * *
```

Fig. 3

At the time of constructing arithmetic problems, the previous knowledge of primary school arithmetic of students was also considered. Some easy problems of arithmetic
were constructed so that students can take interest to solve the problems. Time limit means time factor was also considered for the correct solutions of the problems. Students can take interest and don't feel boredom at the time of solving the problems, was also noted at the time of constructing the problems. For example:

Problem-1:

Observe the sum given below. At first sight it would be made out that it is incorrect. By adding 'b' into 'a', answer 'c' is not obtained. What is the cause? It has happened so that one of the numbers of 'a' and 'b' have been replaced. Find out those numbers and arrange them on proper place. So that sum may be equal to 'c'.

<table>
<thead>
<tr>
<th>a</th>
<th>1 4 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>b</td>
<td>6 5 2</td>
</tr>
<tr>
<td>c</td>
<td>7 8 3</td>
</tr>
</tbody>
</table>

Language of the problem is also main factor to solve the problem. So at the time of constructing mathematical problems the language of the problems was also considered. If the language of the problem or representation is not proper than students puzzle to solve the problem.

The order of the problems was from simple to complex. In constructing the mathematical problems, the easyness and hardness was thought.
4.3.2 Construction of Science Problems

As mentioned above 20 problems of this subject were prepared in the initial stage. Most of them were of general science. 50% of these problems were of physics. Text book of science of Std. IX was used for constructing these problems. Two hidden type of problems were also constructed. To solve these problems students have to use their knowledge of some fundamental principles and observations of science. These hidden type of problems are also funny problems in which students can feel themselves in a play-way situation.

Problem-17 and 18 are also like these type.

Problem 17.

Scattered letters are given in the drawn square. Find out the words showing scientific principles from the square.

Fig. 4

Problem-18

Here are given the scattered parts of the scientific apparatus. Suggest the name of these two apparatus after joining them together.

Fig. 5
Observation and logical thinking are fundamental aspect of learning science. It is said, "Nothing teaches us better than careful observation." So here in construction of problems of science, one problem is constructed about observation and thinking.

Problem-20 is like this.

Here in the figure a glass window in square design is given. Outside the window one thief is thinking about robbery. Inside the window master of the house is watching the activity of the thief. Now, both fired with the pistol. 'c' is the hole of firing of house master and 'd' is of thief. Now observe carefully the picture and show who had fired first.

Two problems of biology are also constructed. Three other problems of physics are also constructed.

At the time of constructing problems of science, three branches of science, i.e. Physics, Chemistry and Biology have been considered.

4.3.3 Construction of Gujarati Language Problems

As mentioned above 20 problems of Gujarati language
were constructed in the initial stage. Reading, writing and reasoning are main factors affecting on language. Funny problems are constructed in this subjects. For example one problem (No.27) is like this that students have to findout the hidden name of the city in given scattered words from horizontal and vertical lines. In problem No.25 the scattered words are given, they have to findout the hidden slogan sponsoring on television for adult education. Spoken language is related to the personality and character of human being. We can judge the personality by his spoken language. So problem No.28 is given for finding the personality that who had spoken the statement. Creativity and free thinking are also main factors in language. Problem No. 30, 31 are of creativity. In problem No.30 students have to combine two words from given list. By joining two words which new word is striking in their mind, they have to suggest. Imagination is also important aspect of language. Free thinking must be placed in language. In problem.31 students have to think a new word after reading a particular word from the given list of the words. They have to think a new word which is not thought by anybody. Computer had taken place in language department. Major role is done by computer in language. So a funny problem is given here. (Problem No.32). Students have to create new words and have to write them in computer language. They have given some symbols for particular words, by using these symbols they have to solve the problem.
At the time of constructing language problems, creativity, imagination, interest and funny nature of the students were considered.

4.3.4 Construction of Social Science Problems

In initial stage 20 problems of this subject were constructed. Students are closely related to their society and surrounding environment. They observe and think about the events arousing around them. So there are many social problems for the secondary students. Students have some particular feeling for their parents, teachers, friends and society related with them. Students face some problems but they do not express them. Students have some particular problems for particular objects, events and situations. So problem No. 34 is constructed to find out the feelings and expression of the students for particular things. They have given some words in division-A and in division-B some feelings are given. They have to join words from A to B, according to internal correct feelings.

When students face the examination they have many problems in their minds. Many misunderstandings are prevailing in their minds about the neighbouring students copying, and getting high percentage, eventhough he himself believes in copying.

Many clever students are inspired to copy. For this purpose problem 35 is being constructed.
Now a days students are addicted towards drugs, so their parents have many complications and problems regarding their children. Many businessmen hunt these innocents to drugs. This is a great problem in the society as well as schools. Problem 36 is formed to make conscious the students.

Many times students are busy in reading, writing and getting high percentage but it does not serve the purpose of allround development. They are found reserve and unfit during their service. They can not adjust themselves in the job or maintain the relationship with others. It becomes impossible for them to get the co-operation of people as they are accustomed to lonliness and suffered from behaviour problems. To solve this, problem No. 37 is formed.

Problem 38 is formed with a view to focussing the attention of the pupils towards perservation of environment and pollution. Students fail to understand the pollution and misguided. They forget their responsibilities and do unnecessary matters. They forget their duties towards the society and country and involve in unnecessary bustle. They face many problems unknowingly. Problem No. 39 is formed for this purpose.

If the students are provided enough guidance of all subjects in the school, they need not any tuition. Yet the parents are inspiring for tuitions for revision and to get high percentage. Now a days many problems existing regar-
Thus the investigator has given problems in primary stage and he has added the different subjects, and he has written manuscript for the trial performance. And for the final stage involving forty problems he has written five books for four subjects. Two books for mathematics, one for science, one for language and one for social science. Investigator has done his level best to give the final form of the problems.

4.4 **PPSA CN ANVIL**

Programme for Problem solving approach is the main body for research study. It must be in perfect form. Average student can use this programme for training. So the programme may be in the form of training. In most of the research study the tryout of the programme is necessary. The programme should be molded through tryout. So the investigator had given some stages for tryout as under and had tried to give the final form of the programme.

4.4.1 **Exploratory stage**

In the initial stage, according to the form shown in 4,3, 100 problems are constructed. Now to give the final
form these are tried out by strategy. Problems are arranged according to the subject matter. By observing the capacity of students of IXth standard the problems are arranged from simple to complex. Every problem is arranged on the basis of complexity and they are tried out. The problems are arranged after knowing toughness of language and solution. For this the performance of the subject teachers are also taken into consideration.

The students who did not face the problems were also included. To find out the solution of the problems, students reflections were also noted down. The difficulties which the students faced were also noted down.

In the beginning whenever the investigator found the chance he continued preliminary test for 100 problems. The members of family, friend circle and other secondary school students were used for this purpose. After completing the preliminary procedure, these 100 problems are constructed for tryout purpose. In this study researcher has gone through the three stages for tryout.

(i) Prepilot tryout
(ii) Pilot Tryout
(iii) Final form
4.4.2 Pre-Pilot Try-out

Pre pilot try-out is the first stage of try-out. It is the first filtering stage. There are many problems in the programme which are difficult for the student. The time limit, toughness and the language of the problems may be difficult for the students. So in this try-out investigator had tried to find out the difficulties for the students when they went through the programme. In exploratory stage there were 100 problems for the programme. After pre-pilot try-out of these 100 problems 30 problems were dropped. The observations at the time of pre-pilot try-out are as under.

It would be more appropriate to discuss the findings along with the observations of this try-out in each subject.

Observations regarding the Mathematical Problems.

(1) Out of 40 total problems of mathematics 15 problems were found difficult to solve.

(2) Among these 15 problems, 5 problems were found difficult to understand their language. The language of these problems were somewhat difficult.

(3) In solving the five another problems students were discussing together, they were unable to solve these problems individually, they were of group discussion.

(4) Among these 15 problems another 5 problems were very difficult and time consuming.
(5). Students were able to solve the 20 problems of science, 20 problems of Gujarati language and 20 problems of social science in pre-pilot try out.

4.4.3 Pilot try out

Another twenty students were selected for pilot try out. Out of 100 problems, they were able to solve 62 problems in time. Subjectwise number of problems included in the pre pilot and pilot form are as under:

**TABLE 4.2**

SUBJECTWISE NUMBER OF PROBLEMS FOR PRE-PILOT AND PILOT FORM

<table>
<thead>
<tr>
<th>SR. NO.</th>
<th>CONTENTS</th>
<th>PRE-PILOT FORM</th>
<th>PILOT FORM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mathematics</td>
<td>40</td>
<td>25</td>
</tr>
<tr>
<td>2.</td>
<td>Science</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>3.</td>
<td>Gujarati Language</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>4.</td>
<td>Social Science</td>
<td>20</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td><strong>62</strong></td>
</tr>
</tbody>
</table>

Out of 100 problems 38 problems were dropped in pilot testing. The main observations are as under:

(i) Students were unable to solve 5 problems of mathematics as they were tough.

(ii) Ten problems of mathematics were difficult to understand the language of the problems.
(iii) In Science subject only 5 problems were dropped due to the difficult language and content of the problems.

(iv) Ten problems of Gujarati language were dropped in pilot try out. The content was looking hard to them. They were unable to give the solution of these problems in time.

(v) Out of twenty problems students were able to solve 12 problems of social science in pilot testing. The language of these problems was looking hard to them. They were not able to imagine the solution of the problems.

In general, in pilot try out the twenty students can solve 62 problems out of 100 problems. They were looking more creative than previous ten students. They also felt some difficulty in solving the problems too. Thus the investigator completed pilot testing. The final form of the programme has been given in further caption.

4.5 FORMAT OF FINAL FORM

For the final form another thirty students were selected from the same class of std.IX. These students were not included in the three groups of the study as well as in pre and pilot testing. These thirty students were able to
solve only 42 problems out of 62 problems which were remaining at the time of pilot try out. The subjectwise position of the pilot form and the final form is shown as under.

**TABLE 4.3**

SUBJECTWISE NUMBER OF PROBLEMS FOR PILOT AND FINAL FORM

<table>
<thead>
<tr>
<th>SR. NO.</th>
<th>Content</th>
<th>PILOT FORM</th>
<th>FINAL FORM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mathematics</td>
<td>25</td>
<td>16</td>
</tr>
<tr>
<td>2.</td>
<td>Science</td>
<td>15</td>
<td>8</td>
</tr>
<tr>
<td>3.</td>
<td>Gujarati language</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>4.</td>
<td>Social science</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>62</strong></td>
<td><strong>40</strong></td>
</tr>
</tbody>
</table>

In final form 40 problems were selected out of 42 problems. Two problems were discarded after discussion for the training programme (treatment).

Five booklets of these problems were formulated. Two booklets of mathematics, one of science, one of Gujarati language and one of social science problems were prepared. The investigator had completed the instructions for every booklet. These booklets are given in appendix. Time limit and suggestions for implementation are discussed in further captions.
individually. Some specific instructions for implementation given in each programme booklet are to be given to the students at the time of administration.

(iii) Table clocks and tressing papers are necessary to note the time and trial required to solve the problems of the programme. The given answerbook is useful to note the procedure of solutions as well as the rough work of the problems.

(iv) The free and controlled climate of the classroom is required. There should not be any disturbances around the classroom. At the time of training, pupils require quiet atmosphere, so that they can think freely and give the perfect solutions of the problems.

(v) Teacher or investigator may be useful to guide the students for their training.

(vi) The support and the readings of the pupils must be required for implementation.

(vii) Co-operation of the other teachers and institution in which the programme is to be held is important.

In short, the gathering of all above discussed major factors for implementation are important and necessary. Investigator had tried to follow all the above necessary suggestions to administer the final form of the Problem solving approach programme.
4.6 TIME LIMIT

At the time of administration of the final form of the programme-treatment, the time limit for the whole programme as well as the time limit per item (problem) was decided beforehand. Generally, at the secondary level, schools have a period of forty minutes duration. As the whole programme was to be completed within ten weeks, it was decided to fix alternate two periods of forty minutes per week. Each item of the different sets of programme required average 8 minutes to be solved. In a way, all the forty items required 320 minutes to be solved.

4.7 SUGGESTIONS FOR IMPLEMENTATION

Implementation is the main aspect of programme or treatment. Implementation indicates the way of training. The time limit, instructions, required material, role of investigator or teacher and role of pupils as well as the climate of the classroom are the major factors of implementation of the programme. With these views some suggestions for the programme are given below.

(i) Ten week programme is enough for this study.
(ii) As the problem solving approach is individual one in nature, the students have to solve the problems