Abstract

Developing problem solving skills leads to improvement in academic achievement. It gives learners necessary confidence to face their day-to-day problems. Training in problem solving skills requires a carefully planned classroom procedure. Since skills, training goes hand in hand with mastery of subject content, the teacher needs to carefully plan out how to teach and what to teach. The learners ought to know the exact strategy used, its significance and how to employ, monitor and evaluate the strategy. It is equally important for them to know how and when these strategies can be transferred to new situations. In these lines, the investigator conducted a study on problem solving ability through Information Processing Approach. For this purpose, he selected the N.M. Govt Hr Sec School, Thirupathur, Sivaganga district. The investigator attempted to develop an Information Processing Approach Model to improve the problem solving ability of the students. The statistical analysis of data revealed the effectiveness of this model on enhancing the problem solving ability in doing physics problems. The major findings are the Information Processing Approach Model significantly enhances the problem solving ability of the students.

I. INTRODUCTION

Developing problem solving abilities in students is one of the primary aims of physics teaching. So proper training should be given to the students to improve their problem solving skills. But the reality is that though they are well versed in the concepts of Physics, they are not able to apply them suitably to new problematic situations. Training in problem solving skills requires a carefully planned classroom procedure. Learning must be truly interactive with the teacher providing an elderly perspective through individualized
attention to learners. Since skills, Training goes hand in hand with mastery of subject content, the teacher needs to carefully plan out how to teach and what to teach. This training must make the information processes and their instructions explicit to the learners. The learners ought to know the exact strategy used, its significance and how to employ, monitor and evaluate the strategy. It is equally important for them to know how and when these strategies can be transferred to new situations. But in practice the students are exposed to very few problems and they are not taught about the Strategies to be followed to solve any type of problems. It does not develop Problem Solving ability among the learners.

II. NEED FOR THE STUDY

The Education commission (1964-66) emphasized the understanding of basic principles, in order to develop problem solving analytical skills and the ability to apply them to new problems. Developing problem solving skills leads to improvement in academic achievement. It gives learners necessary confidence to face their day-to-day problems. If one wants to succeed in all India competitive examinations. IIT entrance, UGC, GATE etc., he must develop his problem solving abilities. But even learners well-versed in concepts, are not able to apply them to new problem situations.

Though a few studies have been made in this direction, a concrete method to improve the problem solving ability among students has not yet been evolved. After careful review of the studies the investigator learned that an optimum level of Information Processing enhances the problem solving ability of the students. It is clear that the existing methodologies are not enough to overcome all these deficiencies and improve the intellectual arid problem solving abilities at all levels of education. Hence the investigator attempted this study.

III. SCOPE OF THE STUDY

The advancement of Science and Technology has caused drastic changes in the lives and habits of most of mankind during the last 50 years. But men’s ways of thought are not yet accustomed to this change. Many have expected science to find answers to all life’s problems. The aim of this study is to help the students to develop their problem solving abilities. This study will throw light on the Information processing approach to problem solving skills. As proposed by the National Policy on Education (1986) there is urgent need to modify curricula and methodologies of learning through appropriate research and development to incorporate elements of problem solving, creativity and relevance. This study is attempted along these lines.

IV. OBJECTIVES OF THE STUDY

The following are the objectives of the study:

i) To design and develop the Information Processing Approach Model to enhance the problem solving ability of learners in doing problems in Physics.
ii) To evaluate the Information Processing Approach Model as a means of enhancing the problem solving ability of learners in doing problems in Physics.

iii) To find out the effect of the Information Processing Approach Model among students, in solving physics problems.

V. SELECTION OF THE SAMPLE
The N.M. Govt Hr Sec School, Thirupathur, Sivaganga district is selected for this study. In the school selected for the study, there are more than 1300 students studying at different levels. Of them the 11\textsuperscript{th} standard students who had Physics as optional subject alone were taken for investigation. They were 57 selected out of 95 students (other than 20 those selected for pilot study) studying physics as a subject in the XI standard, formed the sample of the study. The investigator has adopted an experimental design for the present investigation.

VI. HYPOTHESES FOR THE STUDY
The following are the hypotheses framed for this study:
1. There is significant difference among the three groups in their mean scores of achievement in Problem solving in the Pretest.
2. There is significant difference among the three groups in their mean scores of achievement in problem solving in the post-test.
3. There is significant difference among the control group students in their mean scores of achievement in problem solving in the pretest, progressive tests and the Post-test.
4. There is significant difference among the experimental group students in their mean scores of achievement in problem solving in the pre test progressive tests and the post test.
5. There is significant difference among the experimental group-II students in their mean scores of achievement test in problem solving in the pre test, progressive tests and the post test.

VII. VARIABLES
The present investigation is an attempt to determine the effectiveness of Information Processing Approach Model in promoting the problem solving ability in Physics and to estimate the extent of relationship between selected variables in the most effective Information Processing Approach Model.

a) The Information Processing Approach is the independent variable in this study.
b) The problem solving ability in doing physics problems is dependent variable.
c) Control of extraneous variables:
   i.) Gender - study is conducted only with female students.
   ii.) Location - Investigation is carried out in the same class room situation in the same school.
   iii.) Maturation -Investigation is carried out within the duration of 3 months.
   iv.) Age - Students of the same age group have been chosen (16-17 years).
VIII. EXPERIMENTATION IN PHASES

Phase: I
1. Understanding the technology of Information Processing Approach Model instruction.
2. Developing a systematic model for the application of Information Processing Approach Model instruction in promoting the ability to solve physics problems.
3. Identifying chapters related to appropriate problems for the application of Information Processing Approach Model in the physics textbook at eleventh standard level.

Phase: II
4. Trying out the effectiveness of Information Processing Approach Model with a small group of students as pilot study.
5. Evaluating the effectiveness of the Information Processing Approach Model.

Phase: III
6. Conducting pre-test to assess the entry behaviour of the students in the classroom.
7. Administering of Anxiety inventory, Achievement motivation inventory, and Home Environment scale- tools to the students.
8. Comparing students based on pre-test achievement scores so as to enable them to be grouped in three equal groups as Experimental - I, Experimental - II and Control groups and establishing the equality of the three groups by mean and standard deviation of achievement scores in pre-test.

Phase: IV
9. Teaching of students of experimental group-I to be taught through Information Processing Approach Model with exposure of the model to the students, experimental group -II to be taught through Information Processing Approach Model without exposure of the model to the students, and control group to be taught through the traditional method of teaching.
10. Duration of the treatment would be of three months.

Phase: V
11. Administering the test after the completion of each level of the Information Processing Approach Model so as to enable the investigator to administer eight progressive tests.
12. Administering the post test after the completion of instructional units.
13. Entering, categorizing and analyzing the pre-test, progressive tests and post-test scores.

IX. SCHEME OF DATA ANALYSIS

In the present study, the relevant data obtained from test scores of 57 students in the pre test, progressive tests and the post test have been analysed as follows:

- **Multiple Regression Analysis**
  Multiple Regression Analysis explores the nature of the relations between variables. From this analysis, by using computer program, the co-efficient of variables were calculated and the Information Processing Approach Model was validated by ANOVA.

- **Descriptive Analysis**
This generates information about the nature of a particular group of individuals. Mean and standard deviation were calculated to determine the central tendencies and dispersion of variables.

- **Differential Analysis**
  This tool involves determination of statistical significance of difference between groups with reference to selected variables. It involves Kruskal wallies, non parametric tests, and 't' tests for small samples.

- **Analysis of variance (ANOVA)**
  It is a mathematical technique for partitioning the total variation of a set of data in such a manner as to identify the component sources of variation. This technique enables the researcher to test the hypotheses concerning the equality of more than two population means. It involves the collection of ‘F’ values. In the present study it is used to test whether the difference between means of the Pre-test, 8 Progressive tests, and Post-test are significant.

**X. FINDINGS**

1. In the Information Processing Approach Model, the weight age of the predictor variables (the steps in the Information Processing Approach Model) are found as:
   \[ b_1 = 1.561 \text{ (weight at ‘teacher initiates’)} \]
   \[ b_2 = 0.289 \text{ (weight at ‘verification of previous knowledge’)} \]
   \[ b_3 = 0.589 \text{ (weight at ‘presents the problem’)} \]
   \[ b_4 = 1.082 \text{ (weight at ‘analysing the variables’)} \]
   \[ b_5 = 0.477 \text{ (weight at ‘relating the variables’)} \]
   \[ b_6 = 0.857 \text{ (weight at ‘formulating hypotheses’)} \]
   \[ b_7 = 1.652 \text{ (weight at ‘testing the hypothesis’)} \]
   \[ b_8 = 1.050 \text{ (weight at ‘verification of the solution’)} \]

2. There are no differences among the students in the control group, the experimental group I and the experimental group II in their mean scores on home environment, achievement motivation and anxiety.

3. There are no differences among the students in the control group, the experimental group I and the experimental group II students in their mean scores in problem solving in the pre-test.

4. There are no significant differences among the three groups in their mean scores on problem solving in the pre-test.

5. The control group students do not differ in their mean scores in problem solving in the ten progressive tests.

6. There is a continuous gradual steady increase in the mean scores of experimental group I students as they go through the ten progressive tests.

7. There is a continuous gradual steady increase in the mean scores of experimental group II students as they go through the ten progressive tests.
XI. DISCUSSION

- Stravely Holmer (1993) identified the Information Processing elements as (i) Configurations (ii) Locations (iii) Concentration (iv) Organization (v) Replication (vi) Representation (vii) Recall and (ix) Transformation. Similarly in this study Information Processing Approach Model included eight steps as (i) Teacher initiates (ii) – Verifying the previous knowledge (iii) Presents the problem (iv) Analysing the variables (v) Relating the variables (vi) Formulating hypotheses (vii) Testing the hypothesis and (viii) Verifying the solution. In this study ‘verifying the solution’ gives an effect similar to that of ‘Transformation’ which is one of the elements of Information Processing in Stravely Holmer’s study. Like that, ‘Analysing the variables’ and ‘Relating the Variables’ are highly related to ‘Organisation’ which is one of the elements of Information Processing in Stravely Holmer’s study. ‘Identifying the previous knowledge’ gives an effect similar to ‘Location; which is one of the elements of Information Processing in Stravely Holmer’s study? Like that, ‘Teacher initiates’ needs ‘configuration’ which is one of the elements of Information Processing in Stravely Holmer’s study.

- Vaidya (1979) identified that, sensing the problem was closely identifiable with plasticity in thought processes, fluency or interest in generating difficult problems. Similarly in this study sensing is the strategy rightly fitted in ‘Presents the Problem’ level in the Information Processing Approach Model and the experimental group I and the experimental group II students performance in problem solving increased considerably on the application of this model.

- Starmack. John. (1991) found that if the student used more analysis and synthesis, it improved his abilities to solve complex problems. Similarly in this study the problem solving ability of the experimental group I and the experimental group II students was enhanced at the ‘analysing the variables’ and ‘relating the variables’ levels of the Information Processing Approach Model,

- Hom Robert. R. (1992) described Information Mapping as a methodology for analysis. Similarly in this study 'Information mapping' strategy is rightly fitted in at the 'Relating the variables' level in the Information Processing Approach Model and the experimental group I and experimental group II students’ performance in problem solving was enhanced considerably by applying this model.

- Victor R.Oalciose and Christine Harrington (1991) concluded that the overall proactive problem solving-training that required that students monitor their solution processes (MPS group) resulted in better problem solving performance. Similarly in this study, 'Monitoring the process' strategy is rightly fitted at 'testing the hypothesis' level in the Information Processing Approach Model and the experimental group I and the experimental group II students' performance in 'problem solving improved on the application of this model,

- Vaidya (1979) interpreted that a high loading on the scheme of thought relating to testing and verification of hypotheses. In this study 'Testing the hypothesis’ is rightly identified as a level in the Information Processing Approach Model and the performance of students in...
the experimental group I and the experimental group II increased considerably on the application of this model.

- Maria Cardella Elevar (1989) identified that the low mathematics ability students progressed as problem solvers by verifying their solutions. Similarly in this study the problem solving ability of experimental group I and the experimental group II students considerably increased at the 'Verifying the solution' level in the Information Processing Approach Model.

- Allison, Scott, T. (1992) insisted on the need for a strategy for sustaining student attention and systematic Information Processing in college-level class instruction. In this study a systematic behaviour of Information processing was attempted in the classroom situation. And the performance of the experimental groups I, II increased on application of the Information Processing Approach Model.

- In this study the weight age of the steps of the Information Processing Approach Model are found to be (i) Teacher initiates (1.561) (ii) Verifying previous knowledge (0.289) (iii) Presents the problem (0.589) (iv) Analysing the variables (1.082) (v) Relating the variables (0.477) (vi) Formulating hypotheses (0.857) (vii) Testing the hypothesis (1.652) (viii) Verifying the solution (1.050). If the teachers are given proper training by adopting this model according to this weight age, the students' Information Processing should be activated to the optimum level and the problem solving ability also should be enhanced.

XII. EDUCATIONAL IMPLICATIONS OF THE STUDY

The purpose of education is to improve the cognitive abilities of the students. Problem solving enjoys the highest priority in the learning hierarchy. Developing the Problem solving ability is the ultimate aim of education. The investigator attempted to develop an Information Processing Approach Model to improve the problem solving ability of the students. The statistical treatment of data revealed the effectiveness of this model on enhancing the problem solving ability in doing physics problems. The major findings are:

i. The Information Processing Approach Model significantly enhances the problem solving ability of the students.

ii. The weightage of the steps in the Information Processing Approach Model has been determined by Multiple Regression Analysis followed by ANOVA and will serve as a useful guide.

iii. Stepwise improvement of this model is significant in enhancing problem solving ability of the students.

On the basis of the above findings, the investigator suggests the following in order to improve or rather modify the current educational practices.

i. Teachers should be given proper orientation towards the Information Processing Approach.

ii. Teachers should be trained to develop Information Processing Approach Models for various disciplines and chapters.
iii. The results obtained from the study demand that every child be helped to develop basic skills in problem solving so that the child is motivated to seek, work out and solve problems.

iv. Curriculum planners could pay more attention to improving problem solving ability while constructing syllabus. Problems of various types could be incorporated as exercises in textbooks.

v. The pattern of question papers should also be revised. More importance should be given to solving problems. At least a few of the problems should be given as compulsory questions. That will motivate better, closer attention to problem solving in teaching/learning.

The present research study "Effect of Information Processing Approach on developing Problem Solving Ability in Physics" reveals that activating appropriate processes through an Information Processing Approach to problem solving plays a vital role in improving learners' problem solving ability. Further it is observed that the Information Processing Approach expands the learning schema, since the learner is able to activate appropriate Information Processing. This contributes to meaningful and joyful learning. This facilitates the teacher's task of enabling the students to apply Information Processing Model in enhancing their own problem solving ability.

XIII. CONCLUSION
The various Education Commission Reports insist on the development of the problem solving ability among students at all levels. Problem solving ability is related not only to Mathematics learning but also to the learning of all other subjects. The subject Physics offers more scope for developing the problem solving skills among the learners. It is necessary to optimize students’ Information Processing if they are to emerge as expert problem solvers. So, there is an urgent need to gear up national effort towards the implementation of the Information Processing Approach Model at all levels of education, and in particular at the higher secondary level. It is also imperative to give proper training to the teachers to equip themselves for practicing the Information Processing Approach Model in classrooms. Hence, there is the need to include steps in the implementation of the Information Processing Approach Model in teacher education courses.

XIV. REFERENCES


TO CITE THIS PAPER