Effectiveness of Mastery Learning Strategy and Inquiry Training Model on Pupil's Achievement in Science

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Abstract

The present study aims to investigate the effectiveness of Mastery Learning Strategy and Inquiry Training Model on the achievement of students in Science at VII Grade level. For this purpose a sample of 90 students was drawn from VII Grade students from a school at Rohtak (Haryana) affiliated to CBSE. Three groups of students each comprising 30 students were formed and were labelled as Experimental Group I (E_1), Experimental Group II (E_2), and Control Group (C). All the three groups were equated on intelligence using Cattell's Culture Fair Intelligence Test. Lesson plans on Mastery Learning and Inquiry Training Model were prepared and implemented after pre-testing on Achievement Test. After completion of the instructional treatment achievement test was administered as post-test to students of experimental Group I, Experimental Group II and Control Group. One way ANOVA was used to arrive at the following conclusions: (i) Mastery Learning Group was found to attain significantly higher achievement scores as compared to Inquiry Training Group and Control Group; (ii) Inquiry Training Model of Teaching and Traditional Method of Teaching are equally effective in raising the achievement of students in Science.

Introduction

"The global crusade to universalise basic education and improve its quality is now very much on the world agenda especially in the developing countries. Globally, there is an overwhelming concern over the quality and relevance of education. Undoubtedly, quality of school education is the direct consequence and outcome of the quality of teachers and

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teacher-education system. In this context, importance of quality of teachers in improving the quality of education is far beyond question. Therefore, quality improvement of our teachers education programme is one of the indispensable needs" (Patrick, 2000).

Though the place of teaching of science is at the top of hierarchy of different subjects, the researches in this area have been relatively scanty. The teaching of science in schools generally conforms to the traditional methods and continues to be dominated by teacher, making it as dull and uninspiring as ever before.

Mastery learning strategies have significant effect on students' cognitive and affective development and rate of learning. Mastery learning methods also contribute in increasing the learners' interest and aptitude for learning the subject than traditional approaches. The studies also indicate that mastery learning strategy can compensate learning deficiencies of culturally and socially deprived children.

On reviewing the research literature in the teaching of science extensively, it is observed that the models of teaching of the 'Behavioural System Family' in general and the Inquiry training model, in particular, has not attracted the attention of researchers so far to investigate their effectiveness, usefulness and validity in enhancing the academic achievement of students.

Since the subject of science occupies an important place in the school curriculum there is a need to probe the effectiveness of Inquiry Training Model and Mastery Learning Model. Hence, the investigators have selected two models of teaching to find out their relative effectiveness on students' achievement.

Objective

The study was designed to realise the following objective:
— To compare the effect of Mastery Learning Strategies and Inquiry Training Model of Teaching on Achievement in Science.

Hypotheses

(H$_1$) At post-test stage there will be no significant difference in the mean achievement scores of students taught through:
   (i)   Mastery Learning Model and Inquiry Training Model;
   (ii) Mastery Learning Model and Traditional Method;
   (iii) Inquiry Training Model and Traditional Model;

(H$_2$) At post-test stage there will be no significant difference in the mean gain achievement scores of students taught through:

(i) Mastery Learning Model and Inquiry Training Model;

(ii) Mastery Learning Model and Traditional Method;

(iii) Inquiry Training Model and Traditional Method;

Sample

The sample of the present study comprised 90 pupils studying in three sections of Class VII of an English medium school at Rohtak. The average age of the students was 12+ years. From each section 30 students were picked up randomly. One section forms the control group and the other two sections form the two experimental groups i.e. E$_1$ and E$_2$.

To eliminate the initial variability of intelligence in the three groups, the students were measured on general mental ability test employing Cattell's culture fair intelligence test. ANOVA was applied to find out the difference between intelligence test scores of the three groups. F-value between the three groups was found to be 2.98, which was not significant at 0.05 level. It means that significant difference does not exist between the intelligence of the three groups.

Tools Used

The following tools were used during pre-test and post-test sessions.

1. Culture Fair Intelligence Test by Cattell and Cattell.

2. Science Achievement Test was developed and standardised on the topics, " Electric charges at rest, energy, life processes, air (pollution of air, different constituents of air– O$_2$, CO$_2$ and water vapours), water and sound" from the Science Textbook of Class VII, to measure the initial and terminal achievement of the students.

3. Three forms of Mastery Tests for each of the six units were constructed. Each unit test had 30 questions for 60 marks.

4. Lesson plans were prepared on the above mentioned topics of science using Inquiry Training Model.

Experimental Procedure

The experiment was conducted in three phases:

(i) Pre-testing; (ii) Experimental treatment; and (iii) Post-testing.

Phase I : Pre-Testing

In the pre-test stage, intelligence and achievement tests were administered to the students of three groups i.e. control group, experimental group I (to be taught through Mastery Learning Strategy), Experimental Group II (to be taught through Inquiry Training Model).

Phase II : Experimental Treatment

All the three groups viz. control group, experimental group I and experimental group II were taught by the investigator so as to avoid teacher variable — the control group was taught through conventional method of teaching, while, the experimental group I was taught using Mastery Learning Model and Experimental Group II was taught through Inquiry Training Model. Same topics were taught to the three groups for a duration of 12 weeks.

A. Teaching of Experimental Group I

The group was exposed through Mastery Learning Model. The criteria decided for mastery of the content was 80 per cent mastery of the content by 80 per cent of the students. Indian Model of Mastery Learning (IMML) adapted by Hooda and Jangira (1987) was followed for providing instruction to the students.

B. Teaching Experimental Group II

Inquiry training model by Suchman (1962) was followed to provide instruction to the experimental group II. Discrepant events were prepared on the same content, which was taught to experimental group I; and control group. For teaching the experimental group II through Inquiry Training Model, Lesson Plans for all the six units based on the five phases of Inquiry Training Model were prepared.

Phase III : Post-Test

After completion of the instructional treatment achievement test was administered as post-test to students of experimental group I; experimental group II; and control group.

Analysis and Interpretation of Data

TABLE 1

ANOVA for Post-Test Scores of Achievement between Experimental Groups and Control group

Source of Variation	Degree of Freedom (df)	Residuals		F
		Sum of Squares	Variance	
Between	2	4828.33	2414.16	
Within	87	10944.06	125.79	19.19*
Total	89	15772.39	2539.95	

*   P < 0.01

Table 1 shows that F value 19.19 for df 2/87 for experimental groups and control group is significant at 0.01 level. It shows that there is a significant difference between the mean achievement scores of all the three groups. Since 'F' value is significant 'T' test was employed to test the significance of difference between the mean achievement scores of experimental groups and control group.

TABLE 2

Means, SDs and T-values for Post-Test Scores of Achievement between Experimental Groups and Control group

Group	Number	Means	S D	T-values	Significance Level
Experimental Group I (E_1)	30	79.03	8.11	$E_1 E_2 \rightarrow 5.38$	0.01 level
Experimental Group I (E_2)	30	64.30	12.58	$E_1 C \rightarrow 6.19$	0.01 level
Control Group	30	62.80	11.85	$E_2 C \rightarrow 0.47$	N S

Table 2 reveals that experimental group E_1 achieved more mean score (79.03) than experimental group E_2 (M = 64.30) in post-test. The subjects exposed to mastery learning model of teaching achieved significantly higher mean level of achievement in comparison to students taught through inquiry training model

of teaching and through traditional method of teaching. Similarly subjects exposed to mastery learning model were found significantly higher in comparison to subject exposed to traditional method of teaching. There is no significant difference in the mean scores of achievement between the groups E_2 and C. The small difference in the means that exists cannot however be attributed to inquiry training model of teaching and is attributable to sampling fluctuations or other wise. Thus, it can be concluded that inquiry training model of teaching and traditional method of teaching are equally effective in raising the achievement of students in science. Thus, the hypothesis H_1 at post-test stage, there will be no significant difference in the mean achievement scores of students taught through:

(i)   Mastery Learning Model and Inquiry Training Model is rejected.

(ii) Mastery Learning Model and Traditional Method is rejected,

(iii) Inquiry Training Model and Traditional Method is accepted.

TABLE 3

T-values for the Difference in the Post-Test Mean Gain Achievement Scores of Experimental Groups and Control Group

Group	*Means*	*S D*	*T-values*	*Significance Level*
Experimental Group I (E_1)	48.6	9.25	$E_1E_2 \rightarrow 4.99$	0.01 level
Experimental Group I (E_2)	38.6	5.87	$E_1C \rightarrow 6.35$	0.01 level
Control Group	35.5	6.54	$E_2C \rightarrow 0.56$	M S

Table 3 reveals that experimental group E_1 achieved significantly a higher mean gain score (M=48.6) than experimental group E_2 (M = 38.6). Similarly, the subjects exposed to Mastery Learning Model of Teaching achieved significantly higher mean gain level of achievement in comparison to traditional method of teaching. There is no significant difference in the mean gain scores of achievement between E_2 and C groups. Thus, the hypothesis, at the post-test stage there will be no significant difference in the mean gain achievement scores of students taught through:

(i)   Mastery Learning Model and Inquiry Training Model is rejected;

(ii) Mastery Learning Model and Traditional Method is rejected;

(iii) Inquiry Training Model and Traditional Method is accepted.

Discussion on the Results

The above results are in agreement with those arrived at by Bloom (1971), Patadia (1987), Yadav (1984), Clark et al. (1983), Hooda and Syag (1982), and Block (1971). The results of present study stand reinforced and validated on the basis of findings of other researches cited above.

The results of the present study related to inquiry training model are contrary to those arrived at by Voss (1982), Myer (1975), Ivany (1969) and strike (1975). Ivany (1969) and Collin (1969) reported that inquiry training model works well when the confrontations are strong, arousing genuine puzzlement. Voss (1983) found that this model is equally helpful to both elementary and secondary students. Doty (1985) and Katyal (1985) have also found this model to be superior to traditional teaching. However, the results of the present study indicates that inquiry training model of teaching does not have as much significant impact on science achievement as mastery learning model. The period of treatment might have been insufficient to bring changes (Bloom, 1976). Long term treatment in this regard might have brought significant effect on achievement. However, rigorous research is required to reach at some definite conclusion.

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