Research Article

Effectiveness of Inquiry Training Model on Achievement in Science of Secondary School Students

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Abstract

This study examined the effectiveness of Inquiry Training Model on achievement in science of secondary school students. A purposive sample, consisting of eighty four eighth standard students of a government secondary school in Kozhikode district of Kerala State was adopted and a pre-test -post-test quasi-experimental design with a 2 x 2 factorial matrix was applied for the study. A regular class consisting of forty two students was taken as the control group and they were taught through conventional teaching approach during the experiment. Another division of eighth standard was taken as the experimental group and they were administered Inquiry Training Model by the investigator. The experimental intervention was carried out for a period of five months. Three hypotheses··were tested. Results of the ANCOVA analysis revealed that teaching science through Inquiry Training Model was more effective as compared to the conventional teaching. The analysis also revealed that gender has no effect on achievement in science and that there was no group gender interaction effect due to the intervention through Inquiry Training Model.

Keywords: *Inquiry Training Model, Science Achievement, Secondary School Students, Quasi-Experimental Design, Teaching Effectiveness, Gender Differences, Kerala Education.*

Introduction

Inquiry Training Model, developed by Richard Suchman (1964), is intended to engage students in causal reasoning, teach them to become precise in asking questions, to investigate, to build hypothesis and to test them.

For science education to be effective, teaching methods that place emphasis in; developing higher order thinking skills need to be promoted.

Inquiry Training Model. that stresses on students constructing knowledge in the classroom through inquiry, with teacher intervention is expected to be effective in science teaching.

In an Inquiry Training Model classroom, the teacher first presents the students with a puzzling event that motivates the students to solve the problem. After this, the teacher prompts to ask relevant questions that may lead them to reach solutions. The teacher does not answer the questions directly. She just says 'yes' or 'no' to each question that students ask. The students are required to ask only such questions that contain an idea or guess which the teacher either confirms or rejects: Whenever a question cannot be answered by a 'yes' or 'no', the students are asked to re-phrase the question. Thus, after a number of questions and answers the students would have collected sufficient data relevant to solve the problem and would have established some meaningful relationships among the variables by eliminating irrelevant variables. Next, the teacher asks students 'to organise the data and formulate an explanation for the puzzle.

Joyce and Weil (1992) present five phases of Inquiry Training Model as described below:

Phase I: Confrontation with the problem; explain inquiry procedures; present the problem

Phase II: Data gathering, verification; Verify the nature of objects and conditions; Verify the occurrence of the problem situation

Phase III: Data gathering, experimentation; Isolate relevant variables; Hypothesis and test casual relationships (Students organise the information obtained so that they can derive an explanation for the puzzling event)

Phase IV: Formulating and explaining- formulate rules or explanation

Phase V: Analysis of the inquiry process-analyse inquiry strategy and develop more effective ones. The students are asked to analyse the problem-solving strategies they used. This operation helps students to establish a focus in their inquiry and to facilitate discussion of the problem situation.

According to Passi, et.al. (1987), Inquiry Training Model helps in developing in students, process skills in observing, collecting, and organising data, identifying and

controlling variables, formulating, and testing hypothesis, explanation and inferring among students. Moreover, strategies for creative inquiry and autonomy in learning are also improved.

Review of related literature revealed that few studies have been conducted to test the effectiveness of Inquiry Training Model on science achievement of secondary school students. Also, the existing studies give inconsistent results. This study, therefore, is important since the findings of this study will help improve science teaching in secondary schools by throwing light into the effectiveness of Inquiry Training Model in science teaching.

Hypotheses formulated for the Study:-

Hypotheses

The following three null hypotheses were tested:

H01   There is no significant difference between the mean scores of science achievement of the experimental group and the control group.

H02   There is no significant effect of gender on science achievement of students in the experimental group.

H03 There is no significant interaction effect of treatment and gender on science achievement of students.

METHODOLOGY

Design and Sample

A pre-test-post-test quasi-experimental design with a 2 x 2 factorial matrix was adopted for this study. Purposive sampling technique was used, wherein the sample was drawn from two intact divisions of Standard VIII of the Govt. Vocational Higher Secondary School, Meppayur. The students belonged to the age group of 13-14 years. Overall, eighty four secondary school students, boys (N=44) and girls (N=40), took part in this study. The sample sizes of both experimental and control groups were forty two.

Instrumentation

The main instrument used for this study was an Achievement Test in Science, constructed by the investigator. In addition to this, the Standard Progressive Matrices Test - SPMT (Raven, 1958) was used for measuring intelligence of the participants to partial out the effect of intelligence on the experiment.

Procedure

At the start of the experimental treatment; an intelligence test was administered to both the experimental and the control group as preliminary test to partial out the effect of intelligence on the treatment results. After this, a pretest was administered to both groups to measure achievement in science before the commencement of experimental intervention. This was followed by the experimental treatment for a period of five months, during which the experimental group was taught through Inquiry Training Model and the control group was taught through conventional teaching. At the end of the treatment period, a post-test to measure achievement in science was administered to both groups.

Fifty school periods, each with 40-45 minutes duration, were used for the study. The topics for the experimental treatment were selected from the science textbook prescribed for eighth standard pupils of Kerala State for the academic year 2005- 2006. Out of the seven units in Chemistry and eight units in Physics given in the textbook, three units in chemistry (Water, Solutions and Acids and bases) and four units in Physics (Sound, Static electricity, Electric current, Heat) were selected for teaching. The same units were taught in both the experimental group and the control group.

ANALYSIS AND INTERPRETATION

The scores obtained from the intelligence test, the pre-test and the post-test were subjected to statistical analysis to find the effect of experimental treatment on achievement in science. A univariate analysis of covariance (2x2 ANCOVA) was done on the post-test scores of the achievement test. The post-test scores in achievement in science was taken as dependent variable and the covariates taken were the pre-test scores and intelligence test scores.
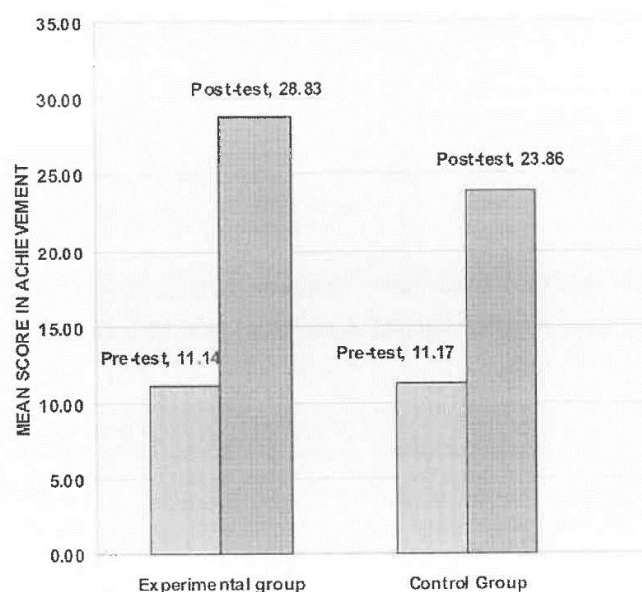
Graph-1 : Pre-test and post-test mean scores in science achievement of the experimental and control groups

Graph-1 reveals that the post test scores of the experimental group increased from the pre-test mean score of 11.14 to 28.83 for the post-test. In the control group, mean score increased from pre-test to post-test (11.17 to 23.86). To test the statistical significance of the difference in the mean scores, 2x2 ANCOVA analysis was performed on the post test scores of science achievement, the details of which are given in the Table I.

Table I: Analysis of covariance associated with science achievement of experimental group and the control group: Test of between Subjects Effects

Dependent variable: Science Achievement					
Source	*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Intelligence	*0.146*	*1*	*0.146*	*0.044*	*0.834*
Pre-science achievement	*276.869*	*1*	*276.869*	*84.407*	*0*
Group	*458.737*	*1*	*458.737*	***139.852***	***0***
Gender	*0.739*	*1*	*0.739*	*0.225*	*0.636*
Group Gender*	*0.507*	*1*	*0.507*	*0.155*	*0.695*
Error	*255.852*	*78*	*3.28*		

Total	59383	84			
Corrected Total	1080.988	83			

The ANC0VA analysis revealed that there is statistically significant difference in the mean scores of the experimental and the control groups in science achievement, as indicated by the F value, F=139.852, p<0.001. Hence the null hypothesis H01, stating that there is no significant difference between the mean scores of science achievement of the experimental group and the control group, is rejected.

The ANC0VA analysis also revealed that gender has no effect on achievement in science as indicated by the F value, F= 0.225, p>0.01. Hence the null hypothesis H02, stating that there is no significant effect of gender on science achievement of students in the experimental group is accepted. Analysis of covariance also revealed there is no statistically significant interaction between group and gender on science achievement, as indicated by the F value, F=0.155, p>0.01. Hence, the null hypothesis (H03) stating that there is no significant interaction effect of treatment and gender on science achievement of students is accepted.

FINDINGS OF THE STUDY

The study revealed that Inquiry Training Model is superior to conventional teaching in improving science achievement of secondary school students. These results are concomitant with the results of the studies conducted by Sivakumar and Prema (1997), Scott and Sigel (1965), Pandey (1986), Al-Khayyat and Abdul Kareem (1981) and Sushma (1987), all of which agree that Inquiry Training Model is more effective than the conventional method in improving student achievement and is contradictory to the study conducted by Alia (2005) who found that Inquiry Training Model of teaching and traditional method of teaching are equally effective in raising achievement of students in science.

It was also found that boys and girls were equally benefited from Inquiry Training Model and gender did not play a significant role in developing science achievement. This result is in contrary to the findings of Gautam (1991) who found that Inquiry Training Model is more effective in the case of girl students. Analysis also revealed that there was no significant interaction of treatment and gender on science achievement.

DISCUSSION

There could be many reasons for the superior performance of the experimental group as compared to the control group. In the experimental group taught through the Inquiry Training Model, the students were actively engaged in constructing knowledge through inquiry with the guidance of the teacher. This confirms Bruner (1966) who said students learn better when knowledge is constructed.

CONCLUSION

It was found that Inquiry Training Model is superior to conventional teaching m improving achievement in science of secondary school students. The study revealed that, facilitating students to construct knowledge by themselves significantly improves the quality of science learning.

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