_____

EFFECTIVENESS OF SUCHMAN'S INQUIRY TRAINING MODEL IN LEARNING SCIENCE

Dr. Manjula Patil
M.A., M.Ed., Ph.D.
Teacher Educator,

_____

ABSTRACT :

        The cultivation of Scientific method of inquiry is essential in Science teaching. Science is changing from an empirical science in which the invariant of concepts and conceptual structures are taking a progressively more important role (Elelyn Klinckman, 1971). Biological Theories are changing due to the development and advances in the investigation. Hence an understanding of scientific method of inquiry is necessary in Science learning which can be developed through participation in laboratory investigation. The pupils themselves should devise and perform the various biological experiments. Based upon the careful observation they have to collect the relevant data and to organise the collected facts logically. Finally they have to reach the findings and these findings must be applied in a new situation. The teacher should suggest these activities and provide a proper situation and assist the students to develop a natural way of inquiry.

KEYWORDS : *Scientific method , Science teaching.*

1.   INTRODUCTION

        These methods of independent and impartial experiments develop the scientific attitude. Such man's inquiry training Model is to teach students a process for investigating and explaining unusual phenomena.

        In Science text books, the scope to inculcate the natural way of inquiry is very limited. Since it is in an expository way and the rhetoric of conclusions are dominant. Such man's Inquiry Training Model provides a way to inquire independently. The general goal of inquiry training is to help students develop the intellectual discipline and skill necessary to raise questions and search out answer stemming from their curiosity (Bruce Joyce and Marshal Weil 1985). In order to provide such a type of natural way of inquiry, it is intended to adopt such man's inquiry, Training Model according to the Indian conditions and to find out its effectiveness.

2.   GENERAL OBJECTIVES:

        To find out the effectiveness of Such man's Inquiry Training Model in learning Science at IX standard level.

3.SPECIFIC OBJECTIVE

1.   To identify the level of Post test achievement scores of IX standard Students in Science through Suchman's Inquiry Training Model and traditional method

2.   To identify the level of Pre test and Post test scores of IX standard students in Science through Suchman's Inquiry Training Model based in the

_____

EFFECTIVENESS OF SUCHMAN'S INQUIRY TRAINING MODEL IN LEARNING SCIENCE

VOLUME - 8 | ISSUE - 4 | JANUARY - 2019
_____

experimental group and traditional method in the control group.

3. To identify the level of achievement in Science both control group and experimental group in pre test and post test

4. To find out significant differences between if any academic achievement in Science of control group pre test and post test among IX standard students.

5. To find out significant differences between if any academic achievement in Science of Experimental group pre test and post test among IX standard students.

6. To find out significant difference if any between the pre tests mean scores of the control group and experimental groups.

7. To find out significant difference if any between the post-tests mean scores of the control group and experimental groups.

8. There is no relationship between pre test and post test of control group with respect of achievement in Science

9. To find out the relationship if any between pre test and post test of experimental group with respect of achievement in Science

10. To find out the Effect size of control group of pre and post test of Science among IX standard students of control group

11. To find out the Effect size of experimental group of pre and post test of Science achievement among IX standard students.

12. To find out the gain ratio between the mean scores of the pre test and post test of the control group.

13. To find out the gain ratio between the mean scores of the pre test and post test of the experimental group.

4. HYPOTHESIS :

1. There is no significant difference between Pre-test and post-test of achievements of Science among IX standard control group students

2. There is no significant differences between Experimental groups Pre-test and Post-test achievement of Science among IX standard students

3. There is no significant difference between pre-tests of the control group and experimental groups with respect of achievement of Science.

4. There is no significant difference between post tests of the control group and experimental groups with respect of achievement of Science.

5. There is no relationship between pre test and post test of control group with respect of achievement in Science

6. There is no relationship between pre test and post test of experimental group with respect of achievement in Science

7. Effect size of control group of pre and post test of Science among IX standard students

8. Effect size of experimental group of pre and post test of Science achievement among VIII standard students

5. DESIGN OF THE STUDY:

Pupils studying in IX standard in Govt. Higher Secondary School, Raichur comprised the population of the study. The population was heterogenous and represented by 200 students. It was represented by only boys. Based on age, socio-economic status, the subjects which they liked most and least, their intelligence, future desires, study habits, studying hours and their achievement marks in the academic examination particularly in Science, a homogeneous group of 60 pupils was selected.

I.Q. Test developed by Dr. G.C. Ahuja was administered to the students for selecting a homogenous group.

_____
Journal for all Subjects : www.lbp.world

2

_____

6. EXPERIMENTAL DESIGN:

The investigator used the equivalent or related measure design Here the relative effects of two treatments were compared on the basis of two groups which were equated on all relevant aspects. To the experimental group such man's Inquiry Training Model was given and to the control group the conventional method of instruction was given.

7. TREATMENT:

Such man's Inquiry Training Model was adopted and packages were developed by the investigator for the purpose of treatment. The pre-test designed by the investigator was given to the subjects (Optics, Magnetism and Electricity Topics) in which the experiment was to be conducted. The reliability of the achievement test was 0.85 (split-half method)

To the experimental group no mention was made about the topic of the lesson since it would affect the inquiry way of learning. But at the same time the investigator motivated the students by showing charts or doing simple experiments in a puzzling way. The investigator provided full freedom to the students to ask any question regarding the events that happen in the class room. The investigator stimulated the questioning strategy towards the goal.

Such man's Inquiry Training Model was implemented in the following phases:
Phase I - Encounter with the problem
Phase II - Data gathering - Verification
Phase III - Data gathering - Experimentation
Phase IV - Formulating an Explanation
Phase V - Analysis of Inquiry Process
A post-test was given to the subjects in order to find out the change by the experimental factor.

8. STATISTICAL ANALYSIS:

Mean, standard deviation and 't' test were computed for the pre-test and post-test scores. The gained mean scores were also computed for the experimental and control groups.

9. RESULT AND DISCUSSIONS:

Objective-1: To identify the level of Post test achievement scores of IX standard Students in Science through Suchman's Inquiry Training Model and traditional method

Table -1
Mean and SD of Post test achievement scores of IX standard Students in Science through Such man's Inquiry Training Model and traditional method

Variables	Tests	N	Mean	SD
Such man's Inquiry Training Model (Experimental group)	E-Post	40	99.08	8.309
Traditional Method (Control group)	C-Post	40	49.33	6.249

It is obviously seen from table 1 that the mean score of the post test conducted to the experimental group through the Such man's Inquiry Training Model is (99.08) higher than the control group (49.33) taught through traditional method to the IX standard students. The mean and standard deviation of the scores secured by the IX standard students in the Pre test and Post tests through the Such man's Inquiry Training Model and the traditional method of the experimental and control group are tabulated and presented in table -1 .

_____

Objective-2: To identify the level of Pre test and Post test scores of IX standard students in Science through Such man's Inquiry Training Model based in the experimental group and traditional method in the control group.

Table -2
Mean and Standard Deviation of Pre test and Post test scores of IX standard students in Science through Such man's Inquiry Training Model based in the experimental group and traditional method in the control group.

Variables	Tests	N	Mean	Mean Difference	SD
Experimental group (Suchman's Inquiry Training Model)	Pre-test	40	36.83	62.25	8.584
	Post-test	40	99.08		8.309
Control group (Traditional Method)	Pre-test	40	36.53	12.80	6.247
	Post-test	40	49.33		6.249

It is obviously seen from table 2 that the mean achievement score of the post test conducted to the experimental group through the Visualization teaching is (99.08) which is higher than the post test of the control group (49.33) through traditional method to the IX standard students. Besides, the mean difference between the pre test and post test of the experiment group is (36.83) whereas it is (99.08) is found to grater. Table-3, displays the details of results gathered by differential analysis.

Table 3:
Mean scores of IX standard students in Science subject of two groups

Sl. No	Groups compared	Test	Mean scores
1	Experimental group	Post test	99.08
	Control group	Post test	49.33
2	Control group	Pre test	36.53
		Post test	49.33
3	Experimental group	Pre test	36.83
		Post test	99.08

The mean differences between pre test and post test scores of the control group and experimental groups are given in the above table. A detailed evaluation of the data given above in the table is analyzed with the formulated hypotheses using differential analysis through calculating the 't' value and the analyzed data are given in the following tables for inferred that significant differences exist between the mean scores of the pre test and post test.

Objective-2: To identify the level of achievement in Science both control group and experimental group in pre test and post test

The level of achievement in Science both control group and experimental group in pre test and post test

Table-4
Percentage level of achievement in Science both Control group and Experimental group in pre-test and post-test

	Control group (%)	Experimental group (%)
Pre test	30.44%	30.69%
Post test	41.11%	82.57%

_____
Journal for all Subjects : www.lbp.world

4

It is inferred that the level of percentage in post test of control group (41.11) is found to be higher than the Pre test. (30.44). It is inferred that the level of percentage in post test of experimental group (82.57) is found to be lower than the Pre test. (30.69). The level of achievement in mathematics in Post test of experimental group is higher than the Post test of control group.

Objective-3: To find out significant differences between if any academic achievement in Science of control group pre test and post test among IX standard students.

Hypothesis-1: There is no significant difference between Pre-test and post-test of achievements of Science among IX standard control group students

Table-5
Statistics of the pre-test and post-test mean scores of the Control group

Test	No of students	Mean	S.D	Mean difference	't' value	Degrees of freedom	significance
C-group Pre test	40	36.53	6.247	12.80	124.83	78	Significant 0.05
C-group Post test	40	49.33	6.249				

The mean of the pre-test scores of the control group through traditional method is found to be 36.53 with an SD 6.247. The mean of the post test scores of the control group through traditional method is found to be 49.33 with an SD 6.249. The mean difference 12.80 is found to be significant for the value 124.83 for 78 degrees of freedom at 5% level of significance. Therefore, the hypothesis is rejected.

It is concluded that there is significant difference between pre and post test mean scores of the control group.

Objective-4: To find out significant differences between if any academic achievement in Science of Experimental group pre test and post test among IX standard students.

Hypothesis-2: There is no significant differences between Experimental groups Pre-test and Post-test achievement of Science among IX standard students

Table 6
The pre and post test mean achievement scores of the experimental group

Test	No of students	Mean	S.D	Mean difference	't' value	Degrees of freedom	Level of significance (0.05 level)
E-group Pre test	40	36.83	8.584	62.25	105.07	78	S
E-group Post test	40	99.08	8.309				

_____
Journal for all Subjects : www.lbp.world

5

_____

The mean of the pre test scores of the experimental group through the conceptual model is found to be 17.65 with an SD 1.87. The mean of the post test scores of the experimental group through conceptual model is found to be 36.75 with an SD 1.99. The mean difference 19.1 is found to be significant for the 't' value 31.21 for 38 degrees of freedom at 5% level of significance. Therefore, the hypothesis is rejected.

It is concluded that there is a significant difference between pre and post test mean scores of the experimental group.

Objective-5: **To find out significant difference if any between the pre tests mean scores of the control group and experimental groups.**

Hypothesis-3: **There is no significant difference between pre-tests of the control group and experimental groups with respect of achievement of Science.**

Table-7
The pre tests mean scores of the control and Experimental group

Test	No of students	Mean	S.D	Mean difference	't' value	Degrees of freedom	Level of significance (0.05 level)
Control group pre-test	40	36.53	6.247				
Experimental group pre-test	40	36.83	8.584	**0.30**	**0.170**	**78**	Not significant

The mean of the pre test scores of the control group through the traditional method is found to be 36.53 with an SD 6.247. The mean of the pretest scores of the experimental group through the Visualizing teaching method is found to be 36.83 with an SD 8.584. The mean difference 0.30 is found to be not significant for the 't' value 0.170 for 78 degrees of freedom at 5% level of significance. Therefore, the hypothesis is accepted.

It is concluded that there is no significant difference between the pre tests mean scores of the control group and experimental groups.

Objective-6: **To find out significant difference if any between the post-tests mean scores of the control group and experimental groups.**
Hypothesis-4: **There is no significant difference between post tests of the control group and experimental groups with respect of achievement of Science.**

_____
Journal for all Subjects : www.lbp.world

6

_____

Table-8
The post test mean achievement scores of the control and experimental groups

Test	No of students	Mean	S.D	Mean difference	't' value	Degrees of freedom	Level of significance (0.05 level)
Control group Post test	40	49.33	6.249	49.75	28.48	78	Significant
Experimental group Post test	40	99.08	8.309				

The mean of the posttest scores of the control group through traditional method is found to be 49.33 with an SD 6.249. The mean of the post test scores of the experimental group through the conceptual model is found to be 99.08 with an SD 8.309. The mean difference 49.75 is found to be significant for the 't' value 28.48 for 78 degrees of freedom at 5% level of significance. Therefore, the hypothesis is rejected.

It is concluded that there is a significant difference between the post tests mean scores of the control group and the experimental group.

Objective-7: **To find out the relationship if any between pre test and post test of control group with respect of achievement in Science**

Hypothesis-5: **There is no relationship between pre test and post test of control group with respect of achievement in Science**

Table-9
Relationship between Pre test and post test of control group with respect of achievement in Science

Control group	N	Mean	r
Pre test	40	36.53	0.995
Post test	40	49.33	

The 'r' value 0.995 control group of IX standard students is significant at 0.01 levels. Therefore, the relationship between pre and post test of control group is strong positive correlation.

Objective-8: **To find out the relationship if any between pre test and post test of experimental group with respect of achievement in Science**

Hypothesis-6: **There is no relationship between pre test and post test of experimental group with respect of achievement in Science**

Table-10
Relationship between pre test and post test of experimental group with respect of achievement in Science

Experimental group	N	Mean	r
Pre test	40	36.83	0.902
Post test	40	99.08	

_____

_____

The 'r' value 0.902 experimental groups of IX standard students are significant at 0.01 levels. Therefore, the relationship between pre test and post test of experimental group is strong positive correlation.

Objective-9: **To find out the Effect size of control group of pre and post test of Science among IX standard students of control group**

Hypothesis-7: **Effect size of control group of pre and post test of Science among IX standard students**

Table-4.11
Effect size of pre and post test mean achievement scores of the control group

Group	Test	No of students	Mean	SD	$\mu = \frac{S_1 + S_2}{2}$	Effect size (E)
Control group	Pre test	40	36.53	6.247	6.248	1.02433
	Post test	40	49.33	6.249		

The effect size for the difference between the means of pretest and posttest achievement scores of the control group through traditional method of Science at the Secondary level is found to be 1.02433 which is considered as a moderate effect size by Cohen (1992). Therefore, the hypothesis is rejected.

Hence, it is concluded that there is a difference between the effect size of pre and post test mean achievement scores of the control group. And the degree of the effect size as estimated by Cohen (1992) is a moderate effect size.

Objective-10: **To find out the Effect size of experimental group of pre and post test of Science achievement among IX standard students.**

Hypothesis-8: **Effect size of experimental group of pre and post test of Science achievement among VIII standard students**

Table-4.12
Effect size of pre and post test mean achievement scores of the experimental groups

Group	Test	No of students	Mean	SD	$\mu = \frac{S_1 + S_2}{2}$	Effect size (E)
Exp- group Pre test	Pre test	40	36.83	8.584	8.4465	3.68496
	Post test	40	99.08	8.309		

The effect size for the difference between the means of pre test and post test achievement scores of the experimental group through the conceptual model for learning Science at IX standard is found to be 3.68496 which is considered as a large effect size by Cohen (1992).

Hence, it is concluded that there is a difference between the effect size of pre and post test mean achievement scores of the experimental group. And the degree of the effect size as estimated by Cohen (1992) is a large effect size.

Objective-11: **To find out the gain ratio between the mean scores of the pre test and post test of the control group.**

The gain ration for Control group taught through traditional method for learning Science at IX standard level.

_____

Gain ratio $\quad = \dfrac{\text{Mean of (Post test score } - \text{Pre test score)}}{\text{Mean of (Full score } - \text{Pre test score)}} \times 100$

$= \dfrac{49.33 - 36.53}{85.85 - 36.53} \times 100.$

= 25.95 %

Thus, it is found that the gain ratio obtained by the control group through traditional method for learning Science at IX standard level is 25.95%

Objective-12: **To find out the gain ratio between the mean scores of the pre test and post test of the experimental group.**

The gain ratio for the experimental group

Gain ratio $= \dfrac{\text{Mean of (Post test score } - \text{Pre test score)}}{\text{Mean of (Full score } - \text{Pre test score)}} \times 100$

$= \dfrac{99.08 - 36.83}{135.9 - 36.83} \times 100.$

= 62.83%

Thus, it is found that the gain ratio obtained by the experimental group through the conceptual model for learning Science at IX standard level is 62.83% whereas it is just 25.95% in the case of the control group.

DISCUSSION:
The conceptual model developed for learning Science at Secondary school level is found to be very effective. The mean difference between the pre test and post test scores of the experimental group is calculated as **62.25** with a significant value of **105.07** whereas the mean difference between the pre test and post test scores of the control group is calculated as 12.80 with an insignificant 't' value of **124.83** at 5% level of significance. The mean difference between the experimental and control group are **62.25** and 12.80 respectively, proving that the Suchman's Inquiry Training Model is very effective rather than the control group taught through the traditional method. It is concluded that there is significant difference between the pre test and post test mean scores of the control group through the traditional method.
The effect size of the control group is not so large as that of the experimental group. The effect size of the experimental group 3.68 which is greater than 1.024, a value decided by Cohen as a large effect size. It shows that the conceptual model is effective for learning Science.
The gain ratio obtained by the experimental group through the conceptual model is 62.83% and that of the control group is 25.95 %. There is a gain in the achievement level to the tune of 62.83% as far as the experimental group is concerned whereas it is 25.95% in the control group treated through the traditional method.

CONCLUSION:
The investigation revealed that the ideas or concepts should not be forced on the student's mind Concept must be developed through a natural way of scientific inquiry. The instructional techniques should allow the student to develop his own thinking. Once such normal way of thinking is stimulated, knowledge develops in a right way. The teacher should not spoil the curiosity by forcing information. Moreover the students must know that all knowledge is tentative.

_____

REFERENCES:

1. **Ahuja, G.C. (1976):** Hand book for group test of intelligence, Agra, National psychological Corporation.
2. **Joyce Bruce and Marsha Weil (1980):** Models of Teaching. New Delhi, Prentice-Hall of India Pvt., Ltd.
3. **Klinckman, Eleyn (1971):** Science Teacher's Hand Book. New Delhi Wiley Eastern Pvt. Ltd,
4. **Verma P.S. and Agarwal V. K. (1980):** Cell Biology, Genetics, Molecular biology and Evolution, New Delhi, S. Chand and Co. Ltd,.
5. **Wilson, John A. R. et., al., (1974):** Psychological foundation of Learning and Teaching. New York, Mc Graw-Hill book Co.,

_____
Journal for all Subjects : www.lbp.world

10