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Effect of Inductive Thinking Model on Achievement Motivation of Students in Relation to their Learning Approach

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Abstract: Achievement motivation is based on reaching success and achieving all of our aspirations in life. Achievement goals can affect the way a person performs a task and represent a desire to show competence. The characteristics associated with student achievement are an emphasis on teaching basic skills, high expectations for student achievement, frequent evaluation of student progress, a safe and orderly school climate, and educational leadership and motivation. Certainly the desire of a student to excel helps him go a long way in the journey of transacting his/her learning objective. The present study was experimental in nature conducted on 100 students assigned to two groups selected form schools of Chandigarh. Revised two factor study process questionnaire (R-SPceQ-2F) developed and standardized by Biggs (2001) to identify deep and surface learning approach and Deo Mohan's Achievement Motivation Scale were used. Instructional material based on inductive thinking model & traditional model of teaching was developed. ANOVA was used to find difference in mean gain scores of two groups. The finding showed significant differences in achievement motivation of two groups. Mean gain differences for learning approach & interaction effects were however found to be non significant.

Keywords: Inductive thinking Model, Achievement motivation, learning approach

I. Introduction

Education is very much intimate with the individuals' process of growth. It is a continuous reorganization or re-construction of the individual life experience. The future of India will be fashioned in the classroom. Society expects learning to result from education in school and results of education are achieved in specific places within schools. Education is provided in the classroom. The classroom is the nucleus where influences on students learning and results from their education are found. Webster and Fisher (2000) are of the view that all the variables that influence learning are found in the classroom in one way or the other. The process of teaching and learning aims at transmission of knowledge, imparting skills and formulation of attitudes, values and behavior. Teaching is a complex activity, which is a cluster of different roles and responsibilities. A teacher has to master multiple roles in order to become more professional. The professional competence can be expanded in two ways: first by increasing the range of teaching strategies that are needed to be employed; second by becoming increasingly skillful in the case of these strategies (Joyce and Weil, 1972). The purpose of teaching is to maximize learning. (Gagne, 1963)

Bruner (1972) emphasized four major features of theory of instruction in effective teaching:

(i) Predisposition towards learning.
(ii) Structural body of knowledge.
(iii) Sequences of material to be learnt.
(iv) The nature and paring of reward and punishment.

II. Models of Teaching

Eggan was of the view that "Teaching models represent prescriptive teaching strategies designed to accomplish particular teaching goals." Joyce and Weil (1990) have given three meanings of teaching models. Teaching models are just instructional designs. They describe the process of specifying and producing particular environmental situations which cause the student to interact in such a way that specific change occurs in his behavior. Teaching model is a pattern or plan which can be used to shape a curriculum or course, to select instructional materials and to guide a teacher's actions. Models are designed to attain specific goals. When a teacher identifies a goal, selects a particular strategy designed to attain that goal, we can say that he is using model approach. A model of teaching consists of guidelines for designing educational activities and environments. It specifies ways of teaching and learning that are intended to attain certain kinds of goals.

Joyce and Weil (1972) developed more than 20 Models of Teaching, which are grouped on the basis of their chief emphasis. They had organized these models into four families, which are as follows: Social Interaction Model, Personal Model, Behavioral model and Information Processing Model.

Inductive thinking model provides backbone to the social sciences curriculum and is based on the work of Taba (1967), a curriculum theorist. Taba concludes that thinking skills should be taught using specific teaching strategies designed for those thinking skills. Furthermore, these strategies need to be used sequentially because one thinking skill builds on the other. The main focus of the model is to develop the mental abilities and give emphasis on concept formation. This involves cognitive tasks in concept formation. This involves cognitive tasks in concept formation. (Mehra 2010, p.187). Taba identifies three inductive thinking tasks and then develops three teaching strategies to induce those tasks. Each task represents a stage in the inductive thinking process as Taba describes it. The first is concept formation (the basic teaching strategy), the second is interpretation of data, and the third is the application of principles. Concept Formation involves (a) identifying and enumerating the data that are relevant to a problem; (b) grouping those items according to some basis of similarity; and (c) developing categories and labels for the groups. Taba's second teaching strategy (interpretation of data) is built around the mental operations she refers to as interpreting, inferring, and generalizing.The third cognitive task around which Taba builds a teaching strategy is that of applying principles to explain new phenomena (predicting consequences from conditions that have been established). In all the nine phases, the classroom climate is conducive to learning and is cooperative. Taba provides the teacher with clear guidelines for reacting and responding within each phase. Teacher's job is to help the students in dealing with more complex data and information. Taba designed this model to create inductive thinking among learners.

III. Achievement Motivation

The learning outcomes approach reflects a conceptual shift towards making learning more meaningful and effective. Learning outcomes are concerned with the achievements of the learner rather than the intentions of the teacher (expressed in the aims of a module or course). They can take many forms and can be broad or narrow in nature (Adam, 2004). Learning outcomes are generally classified into three domains as cognitive, affective and psychomotor. Achievement motivation is based on reaching success and achieving all of our aspirations in life. Achievement goals can affect the way a person performs a task and represent a desire to show competence (Harackiewicz, Barron, Carter, Lehto & Elliot, 1997). Colemann (2001) is of the view that achievement motivation is a social form of motivation involving a competitive drive to meet the standard of excellence. Achievement motivation has been conceptualized in many different ways. Our understanding of achievement-relevant effects, cognition, and behavior has improved. Despite being similar in nature, many achievement motivation approaches have been

developed separately, suggesting that most achievement motivation theories are in concordance with one another instead of competing. A number of factors have been linked with achievement motivation. The five most commonly mentioned characteristics associated with student achievement are an emphasis on teaching basic skills, high expectations for student achievement, frequent evaluation of student progress, a safe and orderly school climate, and educational leadership (Reynolds, Bollen, Creemers, Hopkins, Lagerweij and Stoll, 1996).

LEARNING APPROACH

Students' approaches to learning describe whether they engage in learning environment with learning matters (Spencer, 2003). The educational area describes two fundamental approaches to learning: deep and surface. The deep approach is characterized by student's interest in learning and his/her connection with previous or new ideas, events and conclusions. Deep learners try to understand the real meaning of concepts. The surface approach is characterized by student's lack of interest in the subject matter and memorization of exam knowledge. That approach regard learning as an external state (Spencer, 2003; Byrne, Flood and Wills, 2001).

DELIMITATIONS

The study was delimited with respect to the following

(i) The study was delimited to IX grade science students of English medium schools of Chandigarh affiliated to Central Board of Secondary Education, New Delhi only.

(ii) Twenty five lessons based o, inductive thinking model and traditional teaching model were developed on topics as Atoms and Molecules, Structure of Atoms, Motion, force and Law of Motion, Gravitation, Work and Energy and Natural Resources from the prescribed Science syllabus of class IXth by National Council of Education Research and Training, New Delhi.

(iii) The experimental treatment was delimited to 30 days of the academic session.

IV. Objectives

The study was designed to attain the following objectives:

1. To develop instructional material for teaching science to the students of class IX as per inductive thinking model.
2. To compare the effectiveness of inductive thinking model and traditional model of teaching in respect of affective outcomes viz. achievement motivation
3. To compare the effectiveness of inductive thinking model and traditional teaching model in respect of affective outcomes of learners with deep and surface learning approach.

HYPOTHESES

H_1O The instructional treatments will not yield comparable mean gain scores on achievement motivation with respect to learners of the two treatment groups.

H_2O The instructional treatments will not yield comparable mean gain scores on achievement motivation with respect to learning approach of the three treatment groups.

H_3O The three instructional treatments will not yield comparable mean gain scores on achievement motivation with respect to interaction effect of instructional strategy and learning approach.

SAMPLE

The sample was drawn from representative secondary schools of Chandigarh who were affiliated to Central Board of Secondary Education, New Delhi. Random sampling technique was employed sample was drawn from following schools: Jawahar Navodya Vidyalaya, Sector 25, Chandigarh and Government Senior Secondary School, Sector 47,Chandigarh.

DESIGN

The present study employed an experimental method with 2× 3 factorial design for affective outcomes.

TOOLS USED

The tools used for the present study are given below:

(i) Revised two factor study process questionnaire (R-SPceQ-2F) developed and standardized by Biggs (2001) to identify deep and surface learning approach.
(ii) Deo Mohan's Achievement Motivation Scale (1985).
(iii) Instructional Material in Science was developed based on Inductive Thinking Model and Traditional Model of teaching by the investigator herself.

STATISTICAL TECHNIQUES USED

The following statistical techniques were employed to analyze the data obtained from the experiment in order to test the hypotheses.

(i) Descriptive Statistics like mean, standard deviation, skewness and kurtosis were used to determine the nature of distribution of the scores.
(ii) Analysis of Variance was employed with respect to factorial design 2× 3 for mean gain scores on achievement motivation
(iii) For the significant F- ratio the t-test has been used for testing the significance of difference between the mean scores different groups on variables under study.
(iv) Graphical techniques were used for descriptive analysis and visual perception of the data.

V. Analysis of Mean Gain Scores on Achievement Motivation

- **Analysis of Descriptive Statistics**

The gain scores of students falling into two groups were subjected to descriptive statistics to analyze the effect of subjecting the groups to different instructional treatment on achievement motivation. The Mean, Standard Deviation, Skewness and Kurtosis were calculated. The obtained results for achievement motivation of treatment and control groups have been presented in table 1.

Table 1

A summary of descriptive statistics of mean gain scores for achievement motivation

Variables	Experimental Group					Control Group				
	N	M	SD	Sk	Ku	N	M	SD	Sk	Ku
Surface	25	10.14	4.59	-0.18	-0.80	25	0.9	2.24	-1.22	1.83
Deep	25	10.32	6.17	-0.25	-0.16	25	1.72	3.50	0.67	2.6
Total	50	9.36	4.09	0.25	0.47	50	0.73	2.25	-1.15	1.41

(i) **Mean Gain Scores:** From the table 1 and fig 1 it was observed that mean gain of experimental group was 9.36 and of control group was 0.73 and this shows that the gain in achievement motivation scores was more for the experimental group than the control group. Further the fig 4.11 reveals that mean gain of students of surface learners of experimental group was 10.14 and of control group was 0.9 and this shows that the gain in achievement motivation scores of surface learners was more for the experimental group than the control group. Also for deep learners, it was observed that mean gain of of experimental group was 10.32 and of control group was 1.72 and this shows that the gain in achievement motivation of deep learners was more for experimental group. A bar diagram to substantiate the results have been drawn and presented in fig 1.

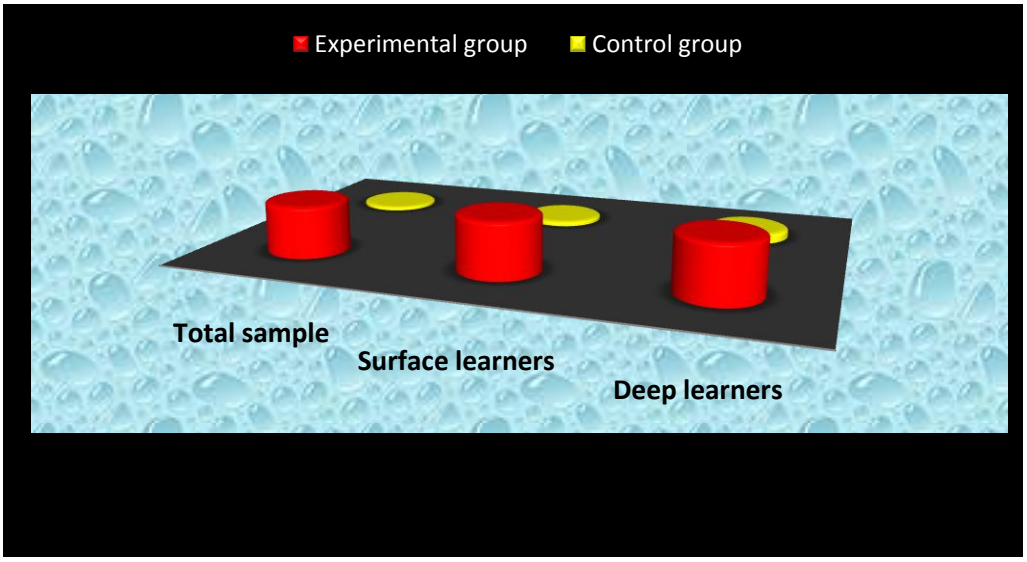

Fig 1: Bar diagram showing mean gain scores on achievement motivation

(ii) **Standard Deviation:** From the table 1 comparing the standard deviations of two groups reveals that standard deviation of the total group imparted instruction through inductive thinking model i.e. experiment group was 4.09 and of control group was 2.25. Further it was found that the standard deviations of surface learners of the group taught through inductive thinking model was 4.59 and of control group was 2.24. Also the standard deviations of deep learners of the group imparted instruction through inductive thinking model was 6.17 and of control group was 3.5.

(iii) **Skewness:** From the table 1 a comparative analysis of skewness indicated the distribution of gain scores for experimental group was positively skewed and negatively skewed for control group. The value of skewness for total group was 0.25 and -1.15 respectively for two groups. It was found that the value of skewness lied within the acceptable limits of normality of distribution and thus the distribution of the measure may be considered as normal. Also a comparative analysis of skewness for gain scores of surface learners indicated that they were negatively skewed for experimental group and control group. The value of skewness was -0.18 and -1.22 respectively for two groups. It was found that the value of skewness lied within the acceptable limits of normality of distribution and thus the distribution of the measure may be considered as normal. Further a comparative analysis of skewness for gain scores of deep learners indicated the distribution of gain scores of deep learners was not skewed in any one particular direction. was -0.25 for the the experimental groups and 0.67 for the control group. It was found that the value of

skewness lied within the acceptable limits of normality of distribution and thus the distribution of the measure may be considered as normal.

(iv) **Kurtosis** : From the table 1 the value of kurtosis of total group was found to be 0.47 for experimental group , hence the curve is leptokurtic for the experimental group and for the control group, the curve is platykurtic with a kurtosis value of 1.41. Also the value of kurtosis for surface learners was found to be -0.80 for experimental group , and 1.83 for control group. It can, thus, be said that the curve is is leptokurtic for experimental group. Further the value of kurtosis for deep learners was found to be -0.16 for experimental group, hence the curve is leptokurtic for the group and for the control group, the curve is platykurtic with a kurtosis value of 2.6.

- **Frequency Polygon of Mean Gain Scores on Achievement Motivation**

The frequency distribution of mean gain scores on achievement motivation for experimental and control groups have been given in table 2.

Table 2

Frequency distribution of mean gain scores of treatment and control groups

		Experimental Group	Control Group
CI	**Xu**	**f**	**f**
-5-0	-2.5	0	10
0-5	2.5	5	40
5-10	7.5	26	0
10-	12.5	14	0
15-	17.5	4	0
20-25	22.5	1	0
		N =50	N= 50

The two frequencies have been depicted through the frequency polygon in figure 2.

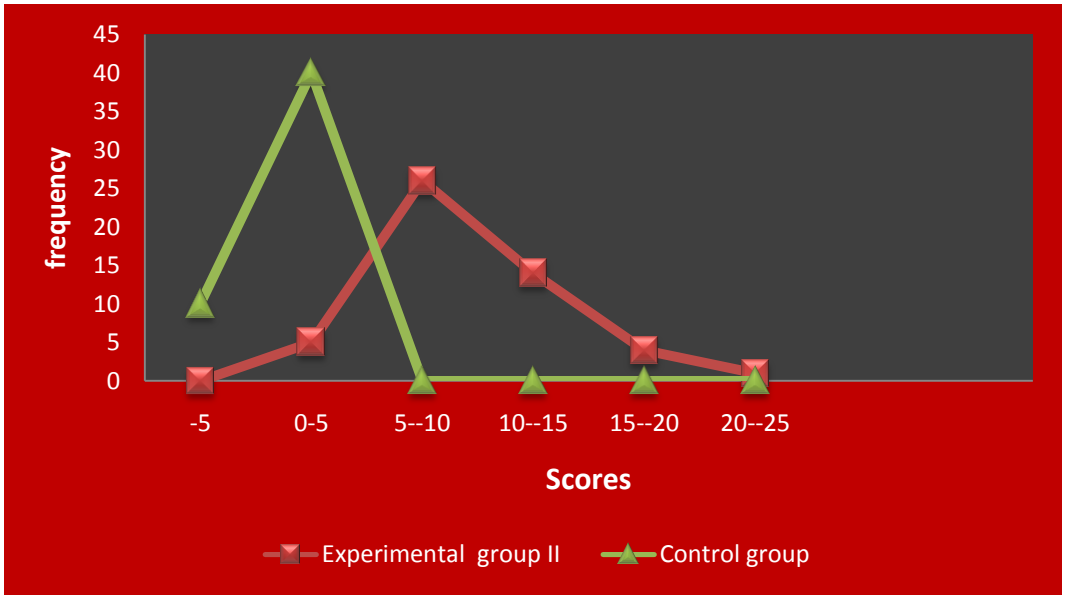

Fig 2: Frequency polygon of mean gain scores on achievement motivation

As evident from the graph in Fig 2 that the polygon of control group deviate markedly in shape, size and expansion from those of experimental group. For the control the polygon extends from -5 to 5 and shows peculiar presence of one modal points at 2.5 for the experimental group the polygon are almost bell shaped having modal value at 7.5.

Cumulative Percentage Curve or Ogive of Mean Gain Scores on Achievement Motivation

The Frequency distribution of mean gain scores of treatment and control groups have been given in table 3.

Table 3
Cumulative frequency distribution of the mean gain scores of treatment and control group

		Experimental Group			Control Group		
CI	**Xu**	**f**	**Cf**	**P. Cf**	**f**	**Cf**	**P. Cf**
-5-0	-2.5	0	0	0	1	10	20
0-5	2.5	5	5	10	4	50	100
5-10	7.5	26	31	62	0	50	100
10-15	12.5	14	45	90	0	50	100
15-20	17.5	4	49	98	0	50	100
20-25	22.5	1	50	100	0	50	100
		N= 50			N		

The two frequency distribution have been depicted through the cumulative percentage curve or ogive in figure 3.

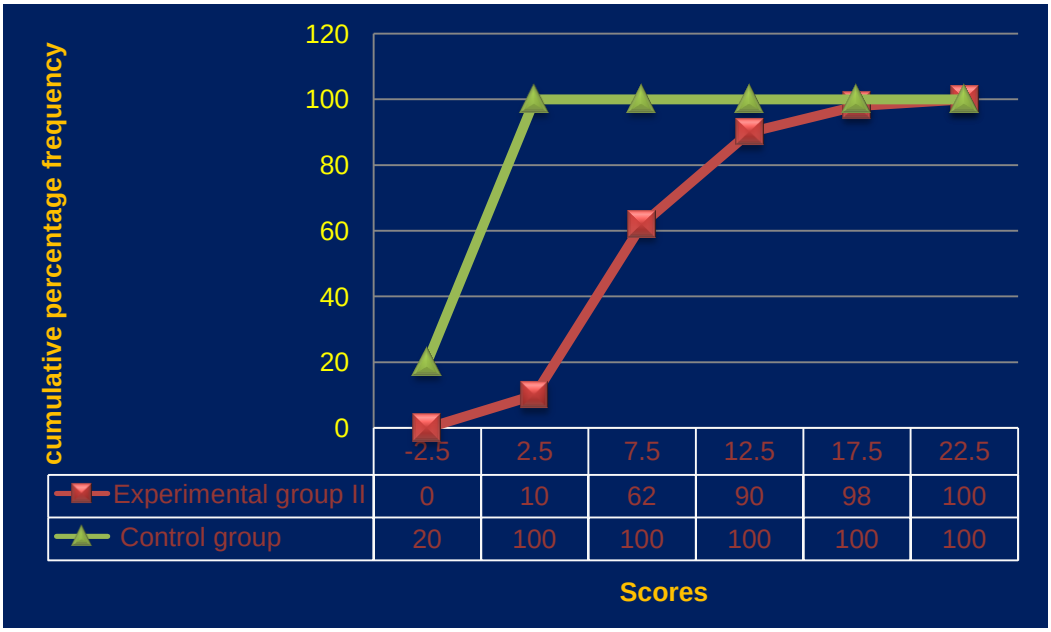

Fig 3: Cumulative percentage curve or ogive of the mean gain scores on achievement motivation

It may be observed from the fig 3 that the nature of the two curves does not appear to be similar and some points of difference are evident.

- **Analysis of Total Mean Gain Scores on Achievement Motivation**

Analysis on the total mean total gain scores of affective outcome –achievement motivation of the two treatment groups was employed. The mean and SD of different sub groups have been presented in Table 4.

Table 4

Mean and SD's of gain achievement motivation scores for different sub groups

Dependent Variable	**Learning Approach**	**Experimental Group**			**Control Group**		
		N	M	SD	N	M	SD
Achievement Motivation	Surface	25	10.14	4.59	25	0.9	2.24
	Deep	25	10.32	6.17	25	1.72	3.5
	Total	50	9.36	4.09	50	0.73	2.25

Table 4 shows that the maximum mean gain observed for learners of experimental group was higher. However when consideration was towards learning approach it was observed that maximum gain was evident for deep learners.

- **Analysis of Variance of Mean Gain Scores on Achievement Motivation**

The means of different sub groups, sum of squares, degree of freedom, mean sum of squares and F-ratio have been presented in table 5.

Table 4.19

Summary of Analysis of Variance (2×2) factorial design

Dependent variable	**Source of variation**	**Sum of Squares**	**df**	**Mean Sum of Square**	**F-ratio**
Achievement Motivation	Instructional Strategy (A)	2264.44	2	1132.22	74.58**
	Learning Approach (B)	0.08	1	0.08	0.005
	A **x** B	6.04	2	3.02	0.19
	Error term	2185.98	94		

**** Significant at 0.01 level**

VI. Main Effect

- **Instructional Strategy (A)**

It may be observed from the table 4.19 that the F-ratio for difference in mean gain achievement motivation scores of inductive thinking model and traditional model is 74.58, which is found to be significant at 0.05 level of significance. This suggested that instructional strategy effect on achievement motivation scores of learners was significant beyond the contribution of chance. Thus the null hypothesis H_1 O : The two instructional treatments will not yield comparable mean gain scores on achievement motivation with respect to learners of two groups, stands rejected at specified level. It may thus be concluded that the use of different instructional strategies to impart instruction in science attribute in development amongst them of different achievement motivation. A bar diagram was drawn to substantiate the results which has been given in fig 4.

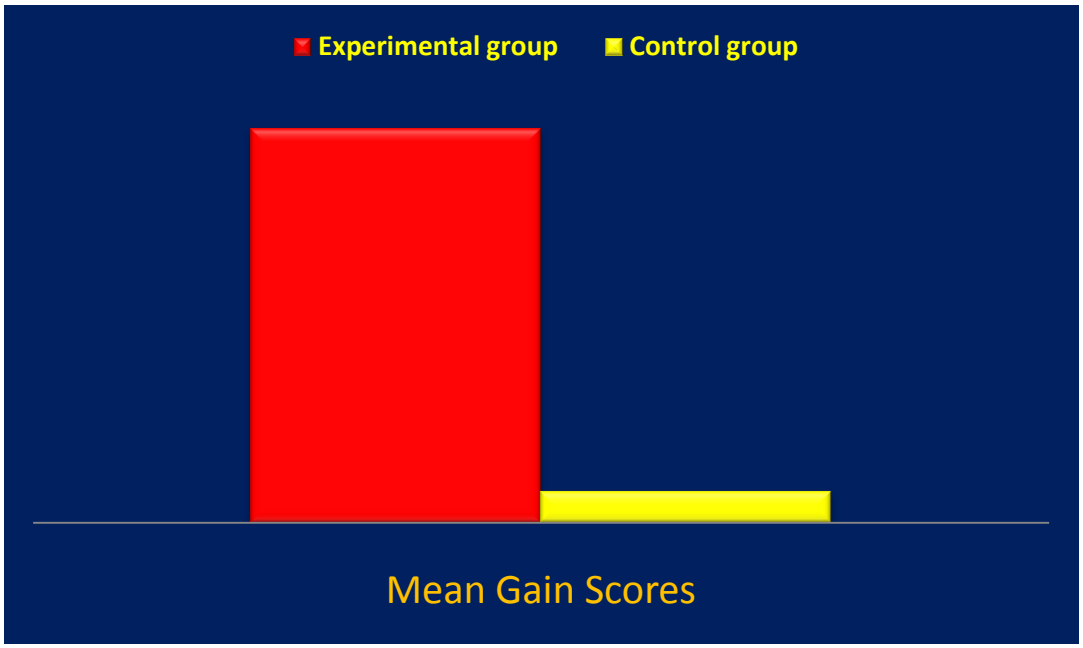

Fig 4: Bar diagram showing the mean gain scores of two treatment groups

In order to probe further, the F-ratio was followed by t-test. The value of t-ratio for different combinations has been given in table 5.

Table 5

t- ratio for different combinations of two instructional strategies

	Experimental Group N M SD 50 9.36 4.09	Control Group N M SD 50 0.73 2.25
Experimental Group N M SD 50 9.36 4.09	-	13.04**

Control Group N M SD 50 0.73 2.25	-	-

**** Significant at 0.01 level**

(Critical Value 1.98 at 0.05 and 2.61 at 0.01 level)

The table 5 and fig 4 that the mean gain scores on achievement motivation of experimental group II i.e. in model group inductive thinking model is 9.36 which is higher than the corresponding mean gain score of 0.73 for control group i.e. traditional model of teaching. The t-value testing the significance of mean difference on attitude towards science of inquiry training model and traditional model of teaching is 13.04, which in comparison to the table value is significant at 0.01 level of significance. Hence it may be inferred that the students imparted instruction through inductive thinking model and traditional instructional strategy yielded significant mean gain scores on affective outcomes- Achievement motivation.

- **Learning Approach (B)**

It may be observed from the table 4. that the F-ratio for difference in the mean gain scores of students with surface and deep learning approach which were imparted instruction through different instructional strategies is 0.005 which was not found to be significant even at 0.05 level of significance. This suggested that learning approach effect on affective outcome- achievement motivation was not signified at the specified level. The data could not provide sufficient evidence to accept the hypotheses H_2 O: The three instructional treatments will not yield comparable mean gain scores on achievement motivation with respect to learning approach. It may be, therefore, concluded that deep and surface learners were not different on achievement motivation.

SECOND ORDER INTERACTION

- **Interaction Effect of Instructional Strategies and Learning Approach (A x B)**

It may be seen from the table 4. the F-ratio for the difference in mean gain scores for the interaction effect is 0.19, which was not found to be significant even at 0.05 level of significance. This suggested that interaction effect on affective outcome- achievement motivation was not signified at the specified level. The data could not provide sufficient evidence to accept the hypotheses H_3O: The three instructional treatments will not yield comparable mean gain scores on achievement motivation with respect to interaction effect of instructional strategy and learning approach. It may be, therefore, concluded that there was no difference in the gain scores achievement motivation due to interaction effect of instructional strategies and learning approach.

VII. Discussion of the Results

It is found that the mean gain scores of deep and surface learners on achievement motivation were comparable. Also the interaction effect of instructional strategy and learning approach also could not cause any significant difference in mean gain scores on achievement motivation. However significant difference in achievement motivation gain scores was found for two treatment groups due to instructional strategy. It was thus inferred that inductive teaching method yield significant achievement motivation gain scores in comparison to traditional instructional strategy.

The results were in tune with the findings of Prakash and Patnaik (2005) who concluded that cooperative learning had a positive effect on achievement motivation. Also Amriault (2003) supported the findings as he revaled that significant difference in motivation levels were observed for two treatment groups.

However the finding is in contrary to those of Kebritchi, Hirumi and Bai (2010) who concluded that no significant improvement was found in motivation of experimental and control group.

With rapidly changing educational scenario, the role of teacher and teaching are changing fast wherein he is enshrined with the responsibility of promoting fruitful learning and stimulating the students by adopting strategies. Science education is spreading its roots deeper and deeper in the name of scientific literacy, encroaching into the whole educational system touching all disciplines. The results of present study stress on the need of using child centered teaching strategies for comprehensive development of the child and stress should be laid on shifting emphasis from passive answer absorbing to active answer seeking, from rigid daily programmes to active flexible schedules, from teacher dominated classroom to child directed and group activities and from memorizing to problem awareness and problem solving

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